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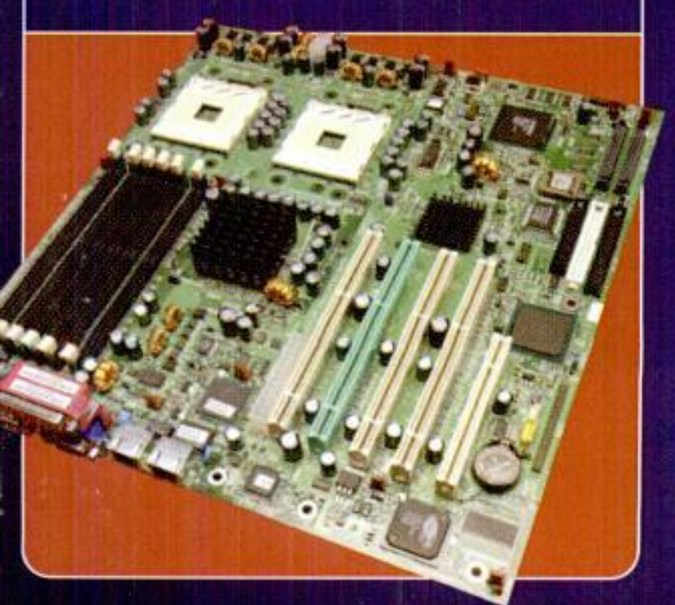

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# Release Notes

## Maximum PC: The *Real* Story

At magazine-publishing school, the instructors constantly pounded a single maxim into our heads: Do everything you can to develop a relationship with your readers. So at *Maximum PC*, we do our best to encourage dialogue with the folks at home. E-mail, of course, helps promote the feedback loop. Why, then, do *Maximum PC* editors ignore so many e-mails?!

No, readers, we don't automatically filter your letters into the trash folder. In fact, I personally read every single e-mail sent to input@maximumpc.com. And as many of you have discovered, I do answer letters, as well as redirect letters to other editors, and encourage them to answer as well. The problem is that our regular day-to-day duties don't allow us to spend much time in e-mail loops.

I can hear the protests now: "But surely, Mr. Phillips, you can find time to read my system specs, and check my biorhythm charts, and have a quick chat with my local hardware guru Ned, who has carnal knowledge of my configuration, then weigh in with your own RAID controller recommendation, can't you?"

Uh, no, Billy. In fact, I can't find time. And the other editors are often even busier. Here's a look at an editor's typical weekly duties:

Develop benchmarks, run benchmarks, troubleshoot hardware failures during benchmarking. Build up test beds, break down test beds, test hardware products ad nauseam. Test games, test apps, test utilities. Attend product demos, conduct phone interviews, read technical papers, travel to trade shows. Write product reviews, write feature stories, write articles for the departments. Edit the writing of coworkers and freelancers. Attend weekly planning meetings, sketch out story outlines, assign articles to freelancers. Box up products, send back products to manufacturers, clean up work areas. Write headlines and captions, proofread the entire magazine, and rewrite almost everything that goes into the magazine at least three times. And when times are rough, listen to irate vendors and readers screaming at you long-distance.

That's probably just half of what we do for 40 to 50 hours every week. And this doesn't include all of the forward-planning, hardware testing, and writing that goes on at home. Now don't get me wrong: Working at *Maximum PC* is one of the best jobs in the world. It's just not always conducive to the first maxim of magazine publishing.

But, what the hell, drop me a line. Chances are pretty good you'll receive a response! ■

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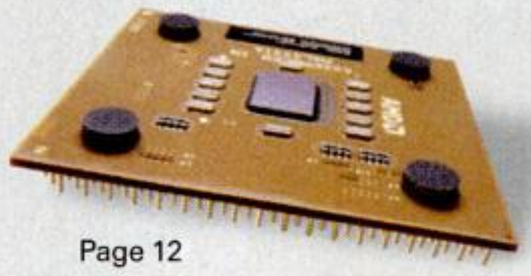

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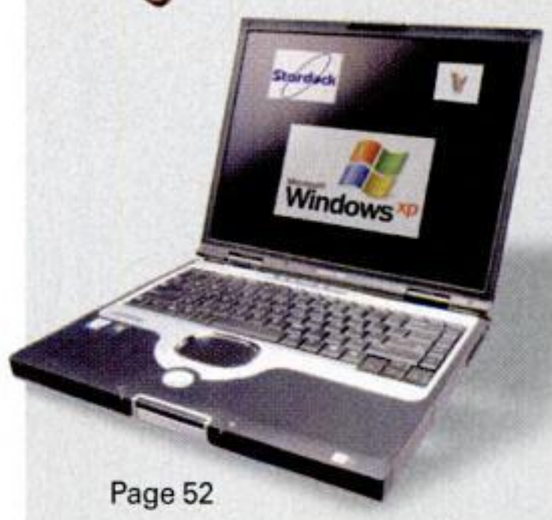


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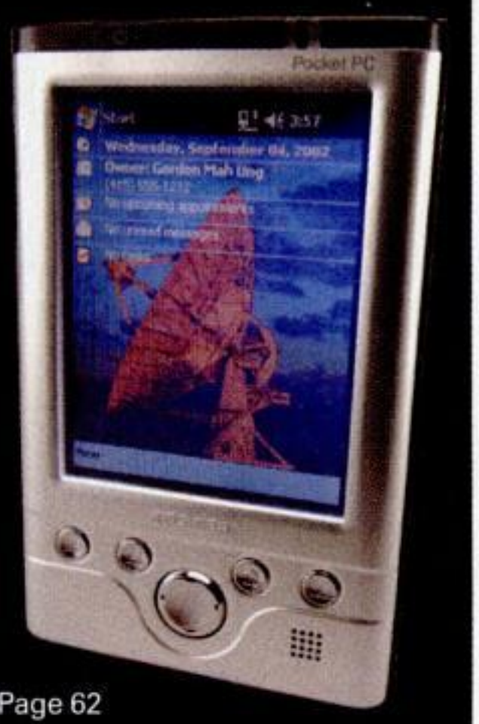


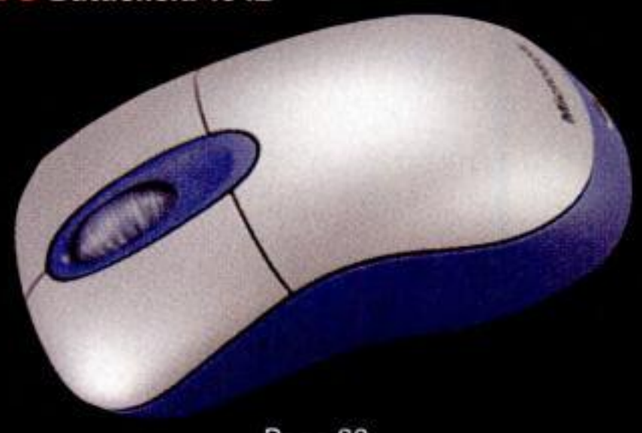

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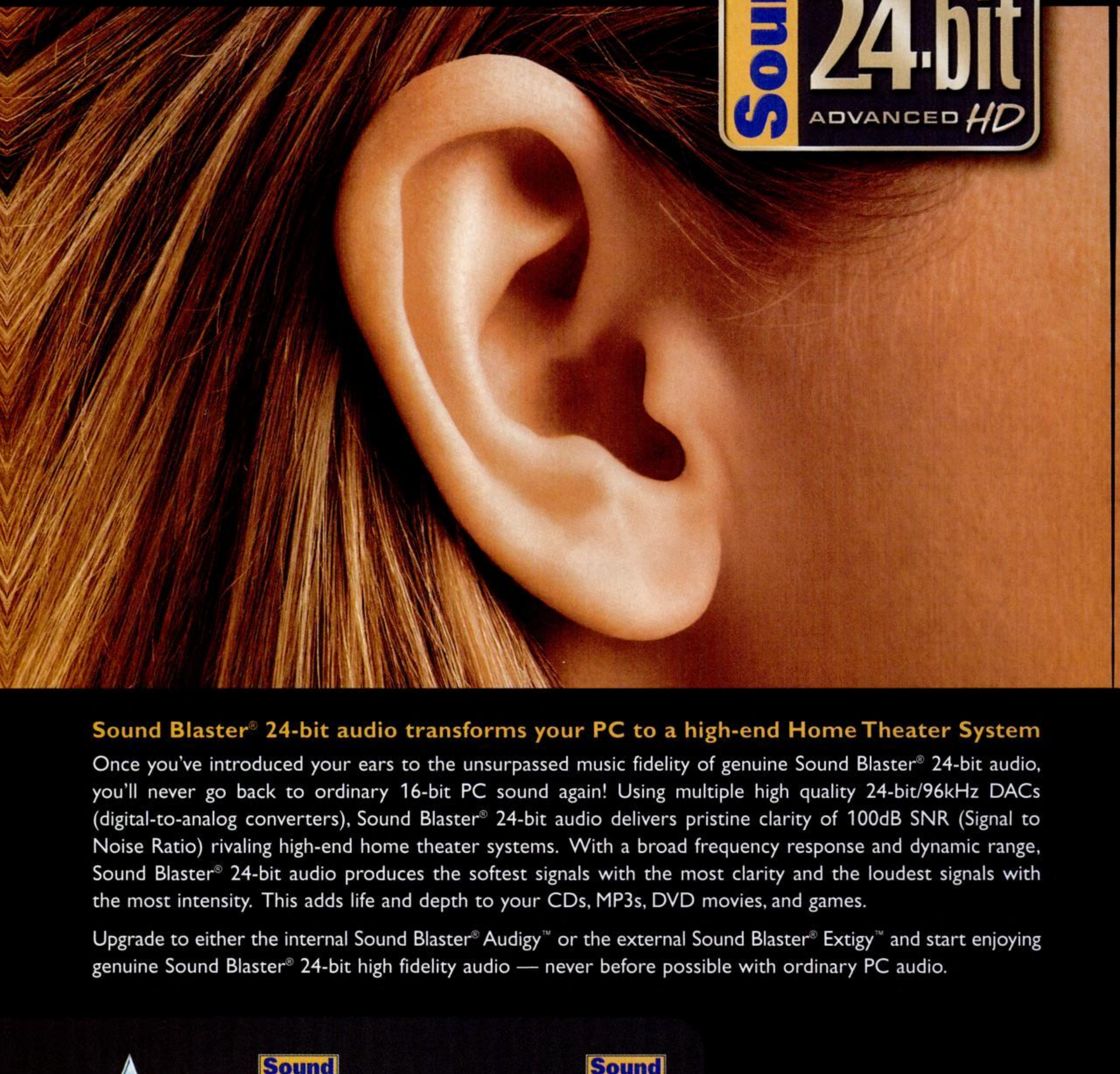

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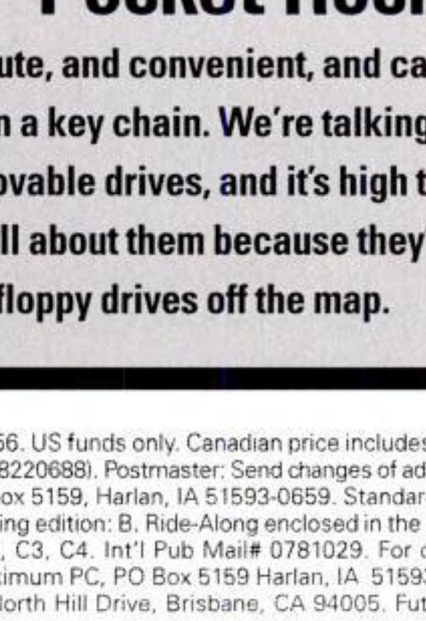
# NOVEMBER FEATURES

## 26 AMD vs. Intel

**You heard it here first. As if from out of nowhere, AMD unleashes a version "B" of its Thoroughbred CPU that challenges the P4's dominance. Our benchmarks tell the whole story.**




## 37 Pocket Rockets!

**They're cute, and convenient, and can be carried on a key chain. We're talking about USB removable drives, and it's high time you learned all about them because they're poised to knock floppy drives off the map.**



## 42 Mobo Minutia

**Ever wonder just how a motherboard comes to be? Even if you haven't, you're sure to be surprised and delighted by our comprehensive guide to mobo engineering.**

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# In/Out

You write, we respond

# Maximum PC Makes Four Left Turns

I know you guys aren't *PC Gamer*, but you inspired me to paint you a car to drive in *Nascar Racing Season 2002*. I figured you'd need a Dream Machine for the race track. So as a thanks for the great work you guys do keeping us informed of everything in the world of PCs, I give you this.

—BRIAN ROGERS

**EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Thanks a lot, Brian! I see you even used our new company logo (Future Network USA). I'm none too adept at banked ovals, but I'll use the car for Sears Point (ahem, Infineon) and Watkins Glen.**

## ALIENWARE'S JEDI OUTCAST GLITCH: RESOLVED

This letter is in regards to our Area-51 system, which *Maximum PC* featured in the October issue "Gaming Rig Showdown."As soon as the system was shipped back to us, our first step was to attempt to run the *Jedi Outcast* benchmark. Confirming what Senior Editor Gordon Mah Ung said, the benchmark ran very slowly—approximately 9fps. Following a standard Alienware tech support procedure, we uninstalled the [ATI videocard] drivers via Windows' Add/Remove Programs applet. This is important, as installing one driver build directly over another can result in conflicting Registry keys and values entered by each driver. Uninstalling via the Add/Remove applet removes the previous driver's entries, eliminating the potential for conflicts. After rebooting, we reinstalled the drivers and rebooted again. Once back in Windows, we attempted to run the benchmark a second time. This run proved successful. In fact, after following this same procedure and installing two other driver builds (including the build ATI supplied to *Maximum PC*), the benchmark continued to run successfully as expected.

—FRANK AZOR,
*Executive Vice-President, Alienware Corp.*

**EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Just as we expressed in our October article, we have faith in Alienware's technical support. We always believed Alienware could work out the glitch, and would never leave a consumer with a machine that couldn't run *Jedi Outcast*. And, indeed, the problem was resolved.**

**It's unfortunate that the machine wouldn't run *Jedi Outcast* with its original driver build, but our entire Lab team did do its best to resolve the problem. This included a full troubleshooting session, including the installation of drivers that had been supplied to us by ATI. We did not Add/Remove the original drivers, only because this is not our standard practice. (In previous Lab experience, we have never had to Add/Remove videocard drivers before installing a fresh build. But as Alienware points out, these instructions are spelled out in the ATI "read me" file.) We're confident that with more communication between *Maximum PC* and Alienware, the driver installation strategy would have been nailed, but unfortunately we just didn't have the system in the Lab long enough for this to happen.**

**All in all, the Alienware Area-51 featured in October is a stellar rig, certainly worthy of *Maximum PC's* highest honors. Like the Area-51 reviewed in the July issue, it's a kick-ass machine, and, yes, it can run *Jedi Outcast*.**

## NOT SO DREAMY?

When I received your current issue (September 2002), I was excited to read about what you assembled for your Dream Machine 2002. However, I was rather disappointed in some of your meager selections. First of all, you didn't include any hardcore cooling. I would've gone with either a Vapochill evaporator case or some kind of custom liquid nitrogen setup.

With this, you could have overclocked your P4 to somewhere around the 3.7 to 3.9GHz level. Also, I would've thrown in two of those 15,0000rpm Cheetah hard drives and used Win2000 instead of WinXP. Win2000 with Service Pack 2 has fewer bugs than WinXP, and you would've gotten kick-ass performance from the two SCSI drives in a RAID 0 configuration.

—IVAN KIRILLOV

**SENIOR EDITOR GORDON MAH UNG RESPONDS: Exotic cooling would've been nice, but we needed something that would**

### CUT, COPY, PASTE

**➤The XBRAT system (September) came loaded with an 1800+ Athlon XP which runs at a clock speed of 1.533GHz. We incorrectly stated that the chip is a 1.4GHz in the body of the review, and 1900+ running at 1.6GHz in the Under the Hood section. Both are incorrect.**

**➤ The Lean Machine had a GeForce4 Ti 4200 videocard, not a Ti 4600 as was reported in the article's "shopping list."**

**➤ In the Dream Classics sidebar for September's Dream Machine feature, we said our 2000 dream PC had 512GB PC800 RDRAM; we obviously meant 512MB.**

**➤ The unlocking kit for the Lean Machine (September) can be purchased at Highspeedpc.com.**



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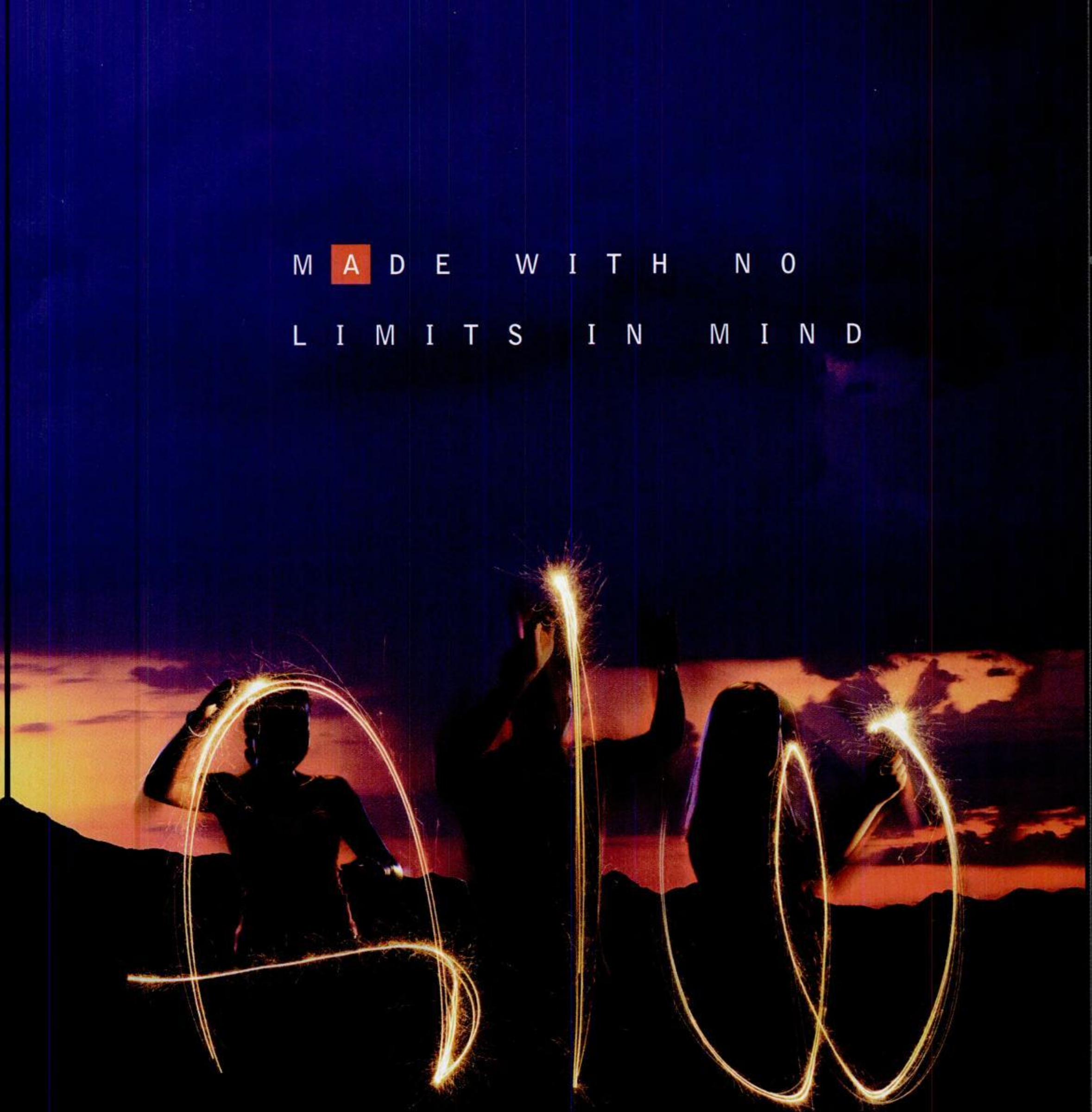

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# COMING NEXT MONTH

## IN THE KICK-ASS DECEMBER ISSUE OF MAXIMUM PC

### Gear of the Year

**The unbelievably demanding men and women of *Maximum PC* pick the best of the best—the hardware that not only survived our Lab testing, but also blew our ever-lovin' minds and withstood the test of time. We'll show you the fastest, the best, the coolest, the most ass-kickingest products, all photographed in luscious glory and grandeur.**

### Wonders of the Digital World

**What do you get for the person who has everything? Answer: That's a stupid question—no one has everything. At least, they haven't got what we found for this year's Holiday Gift Guide, a smorgasbord of PC toys, PC peripherals, and PC paraphernalia. We've got everything from bank account busting state-of-the-art hardware to mesmerizing gifts that cost less than a Happy Meal. And the best part? *You can blow off the holidays and keep everything for yourself!***

### The Big Case Roundup

**You wouldn't put on underwear made of sandpaper, would you? So why put all your precious components into a crappy, brittle lean-to of a PC case? Next month, we make a case for everything the ultimate PC enclosure should include, and review seven brand new models to see how they compare.**

### Plus... She's Back!

**fit inside of the CoolerMaster case that Falcon Northwest so beautifully painted for us. A more elaborate cooling solution would've required serious plumbing, which would have meant cutting holes into the case. What's more, we wanted to strike a sensible balance between performance and reliability. Exotic cooling would have given us more clock speed, but it also would have put our machine in harm's way—Dream Machine 2002 wasn't some kind of dragster intended for a single 1/4 mile run; it was built for extended use without risk of failure. And while liquid nitrogen is indeed interesting, the rapidity at which LN is consumed during the cooling process doesn't lend itself to running a PC for long periods of time.**

**In any tweaking project, you need to weigh the benefits of what you're trying to achieve against the increased risks that may come from, say, having liquid running through your system. In our opinion, Dream Machine 2002 struck the right balance for our readership. As for the Cheetah hard drives, we were committed to running WinXP—it being the most current OS and far more reliable than Win2000 in the long run. WinXP's incompatibility with SCSI at the time of configuration dictated our hard drive decision.**

### BUSSING IT

The September issue article regarding future PC data buses was most interesting ["Life in the Fast Lane"]. This is exactly the sort of excellent technical coverage that makes *Maximum PC* my favorite computer magazine. My question is, Why bother with Serial ATA (SATA)? Wouldn't next-generation versions of USB or FireWire serve just as well, and thereby permit some badly needed simplification of desktop computer design? Also, what about using a very high-speed serial bus to connect with RAM? Although Rambus has a narrower bus, I believe it's still a parallel connection.

Admittedly, I'm not an engineer, but I suspect that the best future PC designs would be those with one or two types of very high-speed serial buses for just about everything (video, RAM, drives, and external peripherals). Is this a reasonable concept?

—SCOTT OCHILTREE

**SENIOR EDITOR GORDON MAH UNG REPLIES: The first implementation of Serial ATA will support up to 150MB/sec transfer speeds. That's almost triple that of USB 2.0 and FireWire (the current version anyway), but not enough for today's (yet alone tomorrow's) hard drives. Serial ATA also has the advantage of being compatible with Parallel ATA—most devices for the two specs can be interchanged using a system of dongles or adapters.**

**I don't know what the plans are for fully serialized RAM, but you can bet there are people working on it. But don't hold your breath. Just as the hard drive industry has billions invested in current technology, so has the memory industry. Intel tried to push RDRAM on the body politic, and got its nose pushed in. (Right now, Intel is working on a dual-channel DDR chipset, and it looks like RDRAM will be off the map. This isn't set in stone, though.) Incidentally, RDRAM isn't a true serial technology, hence the terms "serialized" and "narrow bus."**

### AGP 8X AMENDMENT

In your "Life in the Fast Lane" article, you state that AGP 8x will be available sometime during Q3/Q4 or 2003. As I'm sure you've noticed, some motherboards already support AGP 8x. VIA's P4X400 and KT400 chipsets both support the AGP 3.0 spec, as does nVidia's nForce.

As we begin to see more and more AGP 8x–compatible hardware, such as ATI's Radeon 9700 and Soyo's SY-P4X400 Dragon Ultra motherboard using VIA's P4X400 chipset, will you make an AGP 8x benchmark? I'm confident that many readers would like to see the true performance benefit of AGP 8x "revealed."

—ELMAR MUIZNIEKS

**FEATURES EDITOR LOGAN DECKER REPLIES: What we *meant* to say was that AGP 8x would emerge in Q3/Q4 of 2002, not 2003. We boo-booed. As for the AGP 8x benchmark, we agree that real-world tests are far more useful than synthetic ones, but there are no games coming out in the foreseeable future that even come close to pumping textures and data at 2.1GB/sec, which is the maximum throughput of AGP 8x. At this time, it's your 3D accelerator's chipset and memory that make the difference in speed, not the AGP slot. The AGP spec continues to grow to ensure AGP doesn't become a bottleneck as more demanding games and applications emerge.**

### POLITICALLY REFRESHING

I was slackjawed when I read the column on page 16 of your September issue [Game Theory]. Who is this man openly claiming to be a libertarian? Kudos to Tom McDonald for telling it like it is—especially this month. It was refreshing to get an "America is not the source of evil in the world" point of view, for a change. Certainly, though, kudos to

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the Army for innovation on every front. The freedom afforded to the average American makes ideas like *America's Army* not only possible, but allows them to take flight. Yeah, we've had the $500 toilet seats and $3,000 hammers. But weighing that with how many good ideas have come directly from and in support of our armed services, it's easy to see why we remain the world's only superpower.

—ZACK SARGENT

### POLITICALLY INAPPROPRIATE

Please keep to what you're good at—evaluating PCs and games—and away from analyzing U.S. military policy (Sept. 2002 issue: "Release Notes," and especially McDonald's "I Was a Teenage Bleeding Heart"). The naive proposition that the current function of the military is to protect freedom is simply not borne out by the military's actions in other countries; imperialism is alive and well. If you want to have a full debate in your magazine about these issues, fine—but that requires more than having a columnist spout against simplistic caricatures of the left. And by the way, you don't have to be anti-game or anti-American to be opposed to mindless killing.

—SCOTT BOHNING

### JUST PLAIN THANKFUL

I know the photo of Major Folgate ["Release Notes," September] came in at the eleventh hour, but you should make that a cover for an upcoming issue. It would be a great opportunity to express our support for our men and women who are out risking it all for us. Thanks for everything, Major.

—JOHN HUNTSMAN

### A REBUTTAL FROM CORPORATE AMERICA

I was astonished to read Amy Halperin's reprimand of your "Clean Start" article. I, too, am an IT Manager, and while I wouldn't want an end user performing a clean install on a company PC, I do it all the time. Files inevitably missed during backup? Surely any critical file is backed up routinely. After all, every hard drive fails some day. Missing drivers? Each PC in my company has its own file folder which contains the shipping drivers, although I generally download the newest drivers when performing a fresh install. I've never been unable to obtain drivers for a system. End users can do some amazing things to PCs, and sometimes a clean install is the best way to undo what they claim they never did in the first place.

—CAROL A. FUHR

**EDITOR-IN-CHIEF JON PHILLIPS REPLIES: Carol was just one of many IT professional who wrote in to support *Maximum PC* and rebut Amy Halperin. One such letter-writer, Doug Moore, made an interesting point: "There are two types of IT Managers. The first type has their fingers in everything electronic at their facility, and spends as much time building and repairing PCs as they do administering IT infrastructure. The second type literally does what the job says: They manage IT, which means they spend their time delegating tasks and pushing paperwork pertaining to IT."**

**Hmmm. We'll just leave Doug's comments at that.**

### A CASE FOR BLACK ROPES

While admiring the "black ropes" used in the Dream Machine 2002, a co-worker questioned the purpose of the ropes. I explained to her that it deals with the heat issues inside a PC. She then proceeded to pester me about what type of benchmarking one would use to prove that theory, because to her it appeared that the "black ropes" were simply for a cleaner look. Could you please explain to me how these ropes and "rounded" IDE cables help dissipate heat within a PC?

—ANGELO J. MOLINA

**EDITOR IN CHIEF JON PHILLIPS REPLIES: Well, if one follows the procedures we used in a November 2000 white paper ("Teaching Your System to Breathe"), you'll find that air flow is in fact increased with rounded cables. Increased air flow promotes lower temperatures, and lower temperatures can be measured with proper testing methods. Why lower your case temps? To promote system stability and provide headroom for overclocking. For readers who are interested in the subject, the air flow white paper will be revisited in a special newsstand-only issue that will be out in November 2002. Look for our "Ultimate PC How-To Guide."**

**For Dream Machine 2002, we used generic expandable sleeving and heat-shrink tube purchased from a local electronics store. An upcoming issue of *Maximum PC* will showcase how we added the sleeves. If you can't wait, visit Wirecare.com for some extremely cool cable management supplies.**

### LIES, DAMNED LIES, AND DVD+R

I don't know what you guys have against DVD+R/DVD+RW. It seems like an almost irrational dislike, like maybe you own DVD-R models. I've been able to play a +RW disc created with my HP200e in every DVD player I've tried (including a 1999 Sony Carousel model), as long as it contains at least 20 minutes of video; +R is supposed to be even more compatible. The only drawback is that the media prices are a bit higher than DVD-R, but that will certainly change as DVD+R/+RW takes over. In any case, Sony is supposed to make a +R/+RW/-R/-RW drive this fall, so everybody will be happy.

—UWE BAEMAYR

***"Please keep to what you're good at—evaluating PCs and games—and away from analyzing U.S. military policy ..."***

**FEATURES EDITOR LOGAN DECKER RESPONDS: The only beef we've got with DVD+R/W is that, in every one of our tests, the disc compatibility with set-top players is far inferior to that of DVD-R/W, despite manufacturer claims to the contrary. In our opinion, that's a deal breaker. Of course, we're also turned off by the persistent vaporware announcements from the DVD+R/W folks. Oh, and that unpleasant +R drive upgrade debacle ("We never promised upgradability"). Uh, and the media price, too.**

**But we're going to continue to evaluate disc compatibility as both formats and their respective drives mature. Now that +R media is finally arriving, you can expect to see a brutal head to head in the near future comparing both write-once formats. And we'll review Sony's dual format DVD recorder next month. ■**

**LETTERS POLICY: *MAXIMUM PC*** invites your thoughts and comments. Send them to **input@maximumpc.com**. Please include your full name, town, and telephone number, and limit your letter to 300 words. Letters may be edited for space and clarity. Due to the vast amount of e-mail we receive, we cannot personally respond to each letter.



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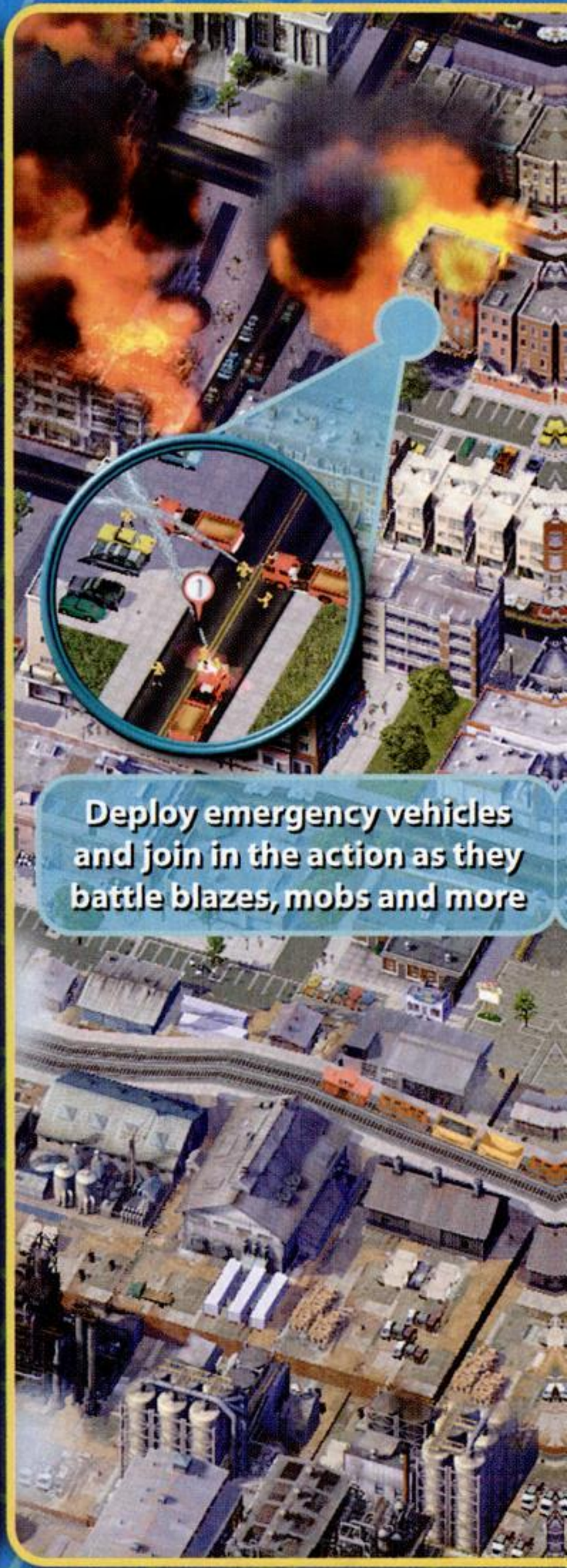
# God's Hand

# May

Sculpt mountains, gouge valleys, seed forests, and bring forth animals to create a world all your own

Summon volcanoes, release tornados, and call down meteors and lightning



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Create a world imagined only by you.

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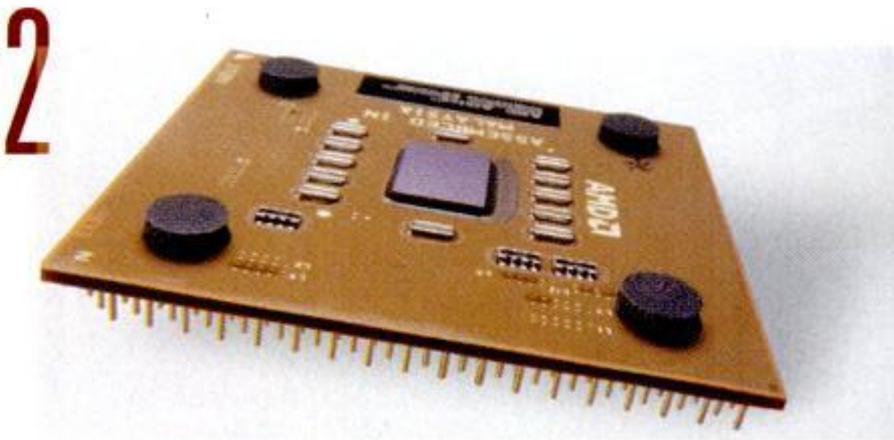
# Quick Start

**The beginning of the magazine, where articles are small**

## AMD Cries Foul over SYSmark2002

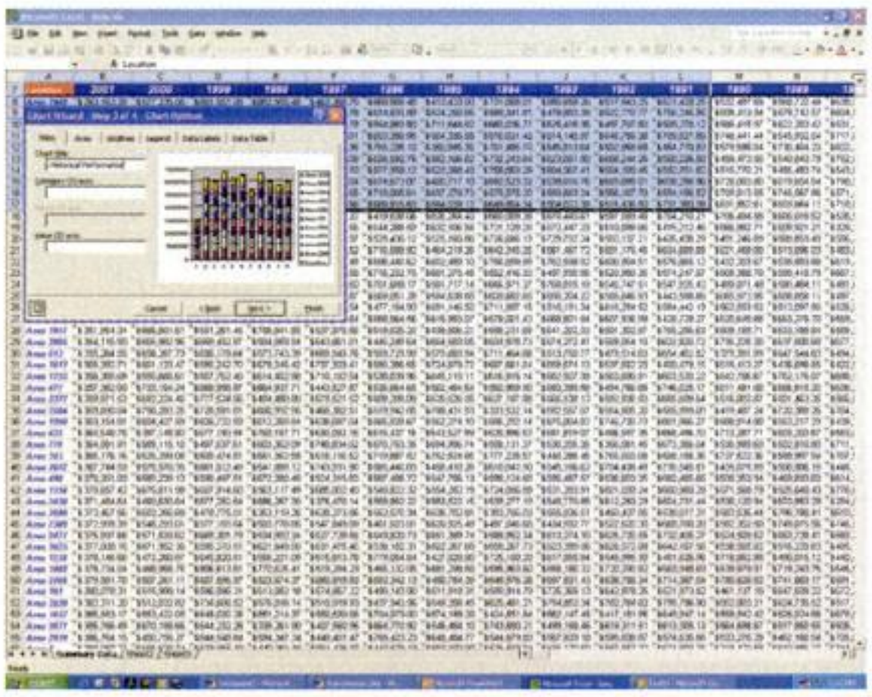
BAPCo's popular benchmark suite is biased toward Intel, company says



**The AMD 2800+ performs relatively poorly under *SYSmark 2002*. Is something amiss?**

Did BAPCo (**www.bapco.com**) intentionally restructure its *SYSmark2002* benchmark to favor Intel's Pentium 4? That's the allegation AMD has made as it prepares to launch new CPUs that will go head to head with Intel's finest (see page 26).

BAPCo's *SYSmark2002*, like the five versions before it, uses popular applications such as Microsoft *Word*, Adobe *Photoshop*, and McAfee *VirusScan* to gauge how quickly a PC performs everyday tasks. The benchmark essentially loads an app, executes an action script, and times how long the PC takes to finish the script. The latest version of the *SYSmark* suite even multitasks different scripts in an attempt to better mimic real-world computer use. The suite includes 14 different applications divvied between two categories (Internet Content Creation and Office Productivity), and spits out a cumulative score based on how long a PC takes to finish each script.



**AMD says *SYSmark2002's* emphasis on bandwidth-intensive sorting in Microsoft *Excel* is among the tasks that unfairly favor Intel.**

AMD says it became suspicious when BAPCo updated *SYSmark2001* to *SYSmark2002*. Apparently, the very same Athlon XP processors that received good scores in *SYSmark2001* were suddenly suffering disappointing scores in *SYSmark2002*. The Pentium 4, meanwhile, was treated kindly by the version update, AMD says.

Mark de Frere, Athlon brand manager at AMD, says AMD engineers tinkered with the benchmark to unravel exactly which tasks it performed in each script. The changes applied to *SYSmark2002* were, as de Frere puts it, "fishy." In a nutshell, tasks in which the Athlon XP traditionally excelled were either removed entirely or de-emphasized by the benchmark's scoring method, and tasks in which the P4 excelled were given more weight. One of the strongest cases AMD makes concerns Adobe *Photoshop*. Several Athlon-friendly filters that were present in *SYSmark2001* were swapped out for filters that favor the P4.

To make sure that future iterations of *SYSmark* are fair, AMD says it has joined the BAPCo consortium, and will contribute resources to ensure that the next version lacks bias. "We will absolutely make sure 2003 is beyond reproach," de Frere says.

A dozen companies contribute to the creation of the BAPCo suite, including Microsoft, Dell, HP, IBM, Infoworld, and of course, Intel. When asked why a company such as HP would approve a benchmark that's biased against a product it sells, AMD told us that not all members of BAPCo are active in the process of building the benchmark. Regardless, de Frere says, "We have one vote out of 11."

BAPCo has denied cooking the benchmark to favor any particular platform. A spokesman said, "BAPCo updates its benchmarks, typically at a rate of once per year, in order to keep up with emerging trends in computer usage." The spokesman said any changes in benchmark workloads were dictated by forward-looking trends in the industry.

BAPCo hasn't exactly hidden its philosophy on PC trends: In a white paper available on the BAPCo web site, the company indicates that *SYSmark2002* is more bandwidth-intensive than its predecessor. A BAPCo rep told us that the white paper "demonstrates the differences between *SYSmark2001* and *SYSmark2002*, and concludes that the workload of *SYSmark2002* is more balanced than its predecessor." In other words, *SYSmark2001* was taking an outdated approach, while the newer version recognizes the greater memory-bandwidth needs of modern computing.

It should be noted that the Athlon architecture was the performance leader during the days of *SYSmark2000* and *SYSmark2001*. So if AMD is correct in its belief that BAPCo has cooked *SYSmark2002* in favor of Intel, it would appear that BAPCo didn't feel the need to do so until just recently. Or so the "cooking theory" would dictate.

Peter Glaskowsky, editor of the *Microprocessor Report*, said that he's spent much time looking into the differences between 2001 and 2002. "I can't help but see signs of bias in the results," said Glaskowsky, "but I can't say there was a deliberate bias because I can't read minds. One way or another, the results were very unfortunate for AMD."

Favoring bandwidth trends is one thing, Glaskowsky said, but the change in *Photoshop* filters is another. Glaskowsky says he agrees with AMD that *SYSmark2001* is more balanced than the new version, but thinks everybody wants to forget about the controversy and move ahead. With AMD now on the BAPCo board, the next version should offer a level playing field for both companies.



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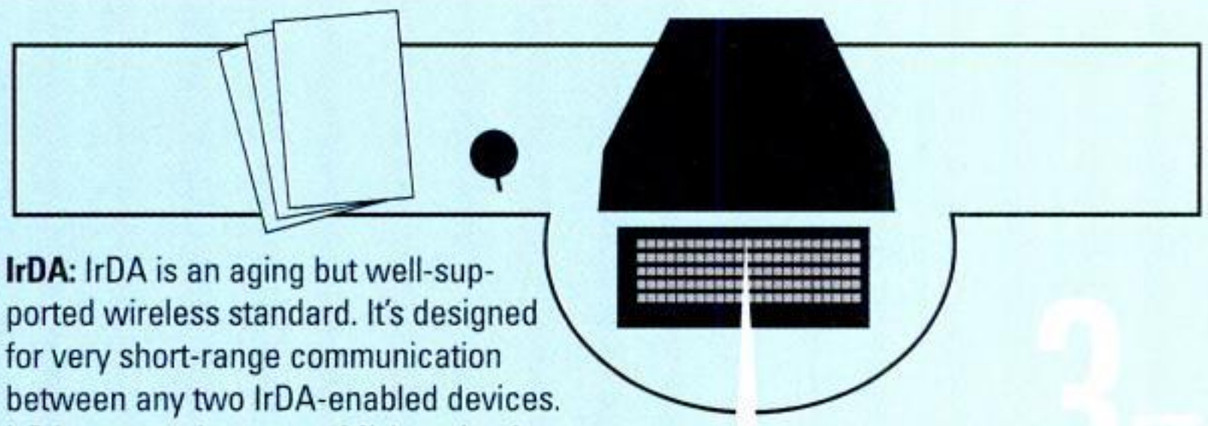
# Wireless Goes The Distance

Comparing the reach of wireless standards

Some of today's wireless standards, like Bluetooth and IrDA, are intended to complement existing networking standards by providing short-range communication between peripherals and PCs. Other specs—like 802.11b, 802.11b, and 802.11g—are battling it out to provide the plumbing for your entire wireless network. Here's a look at the five major contenders and how far their signals are intended to go (at their maximum rates).



**IrDA:** IrDA is an aging but well-supported wireless standard. It's designed for very short-range communication between any two IrDA-enabled devices. IrDA communicates at 4Mb/sec, but is limited to line-of-sight connections.

3 FT

**BLUETOOTH**: Bluetooth was designed to eliminate cables from the desktop by providing short-range, wireless connectivity for peripherals. Because of its limited range and throughput, and its inability to support multiple users, it's not a true networking standard.

30 FT

**802.11A:** At 54Mb/sec, 802.11a is the fastest wireless networking standard available today (thanks to an aggressive compression algorithm). But at 50 to 60 feet, its transmission rate drops off sharply. Adoption of 802.11a has been hampered by very expensive devices and a lack of backward-compatibility with 802.11b—*oops*. The future looks grim for this one.

60 FT

**802.11B:** Also known as Wi-Fi, 802.11b is the real wireless networking standard today. But its lifespan may be limited by its paltry 11Mb/sec bandwidth. Wi-Fi benefits from the excellent range of the 2.4GHz frequency, but it's also somewhat susceptible to interference from other 2.4GHz devices. Look for Wi-Fi to be replaced by 802.11g in the future.

**802.11G:** Although it's still just a spec looking for device support, 802.11g will likely be the next generation of WLAN. Using 802.11a's heavy compression, but operating in 802.11b's more robust 2.4GHz band, 802.11g sends data at a-caliber speeds, but with b-caliber range. 802.11g will also be backward-compatible with ubiquitous 802.11b devices.

120 FT

# PC Security: The Coming Trainwreck

**Imagine the frustration of watching two crowded passenger trains speeding toward each other on a collision course, and there's nothing you can do to stop them.**

**Now imagine three trains. And you're a passenger.**

**That's what I fear is about to happen at the grade crossing of PC security. Three forces are on a collision course: the basic principle that computers make it easier to store, manipulate, and exchange data; the growing need to guard your data against malicious hackers who want to trash it; and the entertainment industry's campaign to control what you can do with the data. Everybody wants more control over systems designed to be open.**

**The latest bid is Intel's new security technology, known as LaGrande. It's supposed to debut in a next-gen x86 processor, perhaps as soon as next year. Intel is modifying the CPU to help enforce security at deeper levels—even deeper than firewall software, antivirus utilities, and other user-level security measures. So far, Intel hasn't publicly released enough technical detail about LaGrande to judge it fairly. But it will certainly cause side effects, as predicted by the Law of Unintended Consequences.**

**A central aspect of LaGrande is low-level resource protection: protected memory, protected storage, and protected program execution. The CPU, working with the core-logic chipset and operating system, will erect internal firewalls. Those firewalls will prevent evil (or honestly misguided) apps from doing bad things to each other, to the OS, or to your storage devices. Sounds reasonable, doesn't it? An accidentally downloaded virus will be fenced off so it can't invade the rest of your system and mung your files. Even your videocard's graphics memory might be protected, so sneaky screen-grabbers can't watch you type passwords.**

**But imagine how a record company might leverage this technology. The same internal firewall that stops a virus from corrupting your *TurboTax* files might also stop your audio software from ripping a CD. Your 1040 is safe, but sorry, no more party mixes. And, oops, the graphics-memory protection that defeats the sneaky screen-grabbers might also disable your Print Screen key.**

**Don't get me wrong. I want my PC to be secure, and I don't promote piracy. The dilemma is that user-friendly computing and safe computing are almost diametrical opposites. More of one frequently means less of the other. And both worthy goals are distorted by the gravitational pull of digital content management.**

**Stay alert and vocal about Intel's LaGrande, Microsoft's Palladium, the PC industry's Trusted Computing Platform Alliance, and the U.S. government's Digital Millennium Copyright Act. Maybe the meek shall inherit the Earth, but meanwhile they'll get screwed.**

*Tom Halfhill was formerly a senior editor for* Byte *magazine and an analyst for* Microprocessor Report. *He is now a technical writer/analyst in Silicon Valley.*



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# HyperThreading to Debut in 3GHz CPUs

Offers "free performance" if you're running the right OS

Intel has announced plans to activate HyperThreading in all P4 processors running at 3GHz and faster. The technology helps a compatible OS utilize CPU resources more effectively by splitting the chip into two virtual processors running in parallel. The two virtual CPUs can then execute separate instruction threads simultaneously. Intel says HyperThreading can provide a performance boost of up to 25 percent in multithreaded apps or during application multitasking. The technology consumes just a small portion of the Pentium 4 die and is virtually free to implement, Intel says.

HyperThreading has been available for sometime in the Xeon platform, but has been fused-off in desktop P4s. The P4 HyperThreading is essentially the same as Xeon HyperThreading, but Intel says it has continued to refine its algorithms for better performance. With a BIOS update on chipsets that support the technology, you'll potentially be able to drop in a new 3GHz P4 and see two CPUs in your task manager. Intel is recommending that people run Windows XP Pro or Home for proper support. Although the Home edition doesn't support SMP dual-processor systems, it does allow HyperThreading's two *virtual* CPUs.

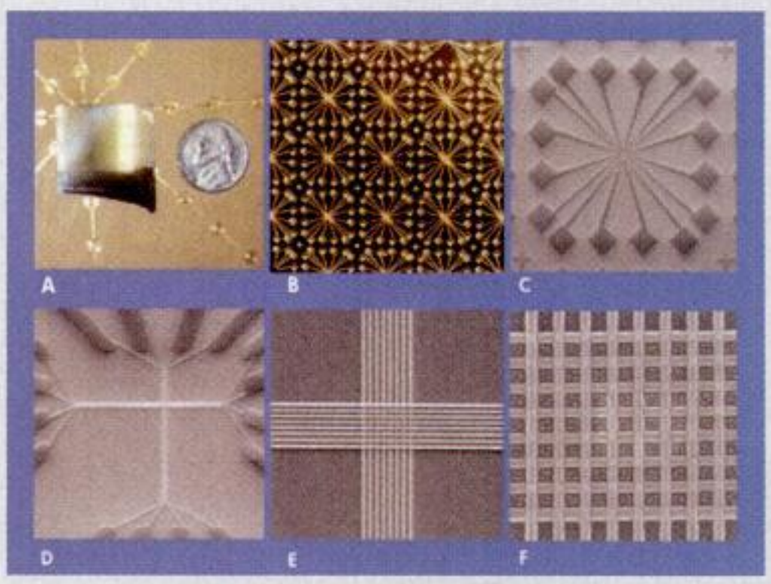
**The "HT" logo at the upper right will distinguish HyperThreaded CPUs from the non-Hyper Threaded variety.**

# Good Things, Small Packages

HP creates the world's highest density memory

The people at Hewlett-Packard's Quantum Science Research Labs are celebrating the creation of a 64-bit prototype circuit that's so small, you could fit more than 1,000 across a single strand of hair. The technology is able to retain information without a constant source of power (which only today's slow flash memory is able to do), and it could be produced via a relatively inexpensive "printing" method called nano-imprint lithography. This could keep prices low once the circuits are mass-produced.

The images you see below, from optical and scanning electron microscopes, show the surface of the prototype chip, at approximately 10x higher magnification for each image.




**The first image (A) shows a wafer on which 625 individual circuits have been imprinted. As we zoom into the chip, we can see the cross-wired structure of each circuit (E). A single bit can be stored at each of the intersections of the eight vertical and horizontal "wires" (F).**

## FUN-SIZE NEWS

### PGP 8.0—Born Free!

The newly-formed PGP Corporation of Palo Alto bought all the *PGP* (*Pretty Good Privacy*) assets from Network Associates in July 2002 and is releasing *PGP 8.0* this month.

PGP Corporation is reviving the entire repertoire of *PGP's* greatest hits, including *PGP Mail* (a suite of encryption utilities for e-mail and instant messages), *PGP Disk* (encryption for entire disks), and PGP for Palm and Windows CE handhelds. A freeware version for personal use will be made available this year as well. Keep an eye out for it at www.pgp.com.

### Linux Squims Over Worm

Smug Linux users are now scrambling to patch their Apache web servers, following initial reports of the first worm targeting the open source OS. Dubbed "Linux.Slapper.Worm," it uses a so-called OpenSSL buffer overflow exploit to allow remote attackers to execute code on an infected PC.

Symantec's Security Response web site reports at least 3,500 infections, affecting distributions of the Apache Web Server from SuSe, Mandrake, RedHat, Slackware, and Debian, among others. This code exploit affects only Intel systems, and can be thwarted by updating the Apache server to its latest version.

### File Sharing by Phone

With the same kind of fearless bravura that a company called Napster once displayed, a French company named Apeera is announcing file-sharing technology for users with WAP-enabled mobile phones (that's WAP, as in Wireless Application Protocol). The Apeera client resides in the mobile handset and allows users to access their own storage area on an Apeera server, uploading and downloading ringtones, Java games, and images. There's no word about when the technology will be available to end users, but we're always looking for another way to piss off the RIAA.

### PC Pay-Per-View

If you've been less than eager to hit up the pay-per-view web site CinemaNow (www.cinemanow.com) and download 700MB of data for the pleasure of watching *Cannibal! The Musical*, you may want to have another look. Warner Bros has announced it will make some of its catalog available to the site. *Harry Potter and the Sorcerer's Stone* can be downloaded for $3.99 and viewed on an unlimited basis for 24 hours. Just be forewarned: The technology uses "anti-piracy" software from Microsoft.

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# Night Chalker

## Urban crop circles expose wireless networks

Who's that strange figure with the laptop and makeshift antennae fashioned from a Pringles can? He waving the can around and scrawling on the sidewalk. And then as quickly as he appeared, he's gone, leaving behind strange symbols on the sidewalk in chalk.

Don't be alarmed: You've just witnessed a "warchalking."

Warchalkers wander major metropolitan areas in search of wireless network access points. When an access point is found, its location and settings are left behind in chalk for others to observe and exploit. The name is derived from "war-dialing," which refers to the old-school method of modem-dialing mass quantities of phone numbers until a stranger's computer picks up.

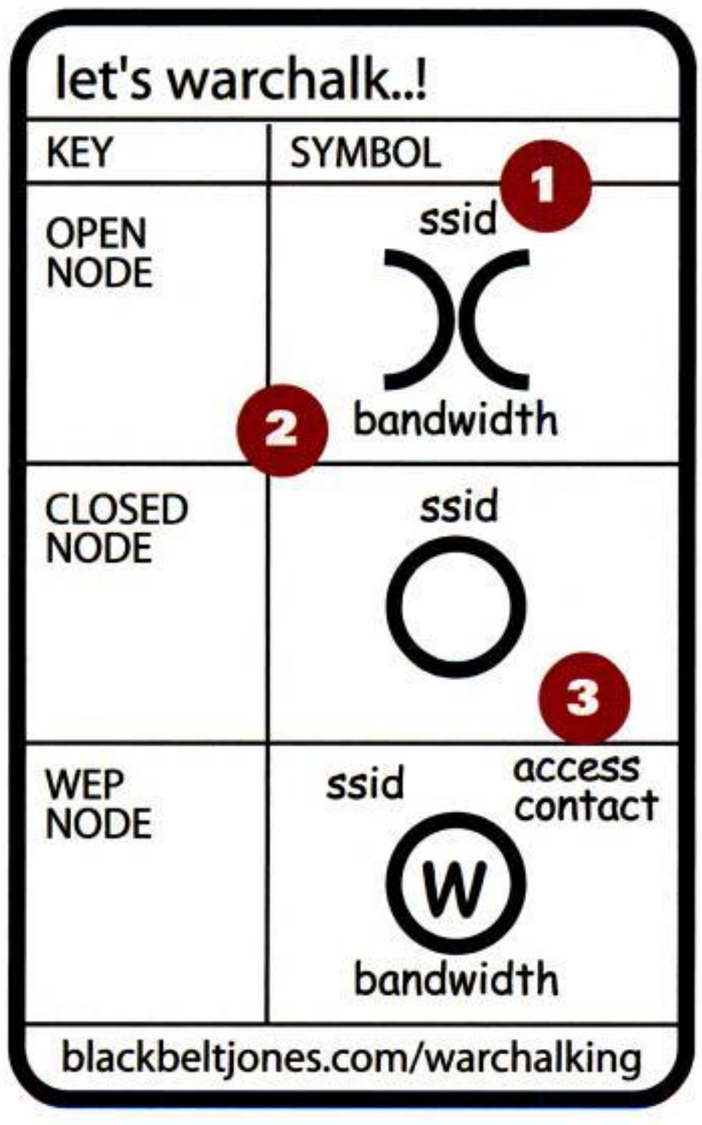
"Warchalking" may sound aggressive and hax0r-ish, but it's actually a fairly benign practice that can help advertise access points meant for public use. The symbols can also alert homes and private businesses to insecure or misconfigured wireless networks. After all, no one wants strange computer nerds jumping on their networks and stealing bandwidth.

Aaron Swartz, one of the pioneers of warchalking symbols, offers the handy wallet guide you see below at **www.blackbeltjones/warchalking**.

**OPEN NODE: Open nodes usually have SSIDs that are not obscured, and have DHCP enabled. An open node says "Come on in!"—whether or not the owner of the access point intended it to.**

**CLOSED NODE: These nodes require some kind of special setup in order to access them, such as knowledge of the network or workgroup name.**

**WEP: This indicates a closed node that also uses encryption. Unless you know the key or are willing to hack through the encryption, there will be no hopping on this network.**




**1. SSID: Here's where you'll find the unique SSID that separates one wireless network from another. That is, it *should* be unique, but often will just be "Default" or "Any."**

**2. BANDWIDTH: Warchalkers use this space to scrawl the network's bandwidth. There isn't a standard yet for expressing the throughput, but common sense dictates that if it says "2000," it means you've got 2Mbs to work with.**

**3. ACCESS CONTACT: You might find an e-mail address written here, or some other type of information required to access the network.**



# Violence Isn't All Fun and Games

Growing up in New Jersey, going to school in New York, the Mob was always just a part of the cultural landscape. (Some of them were literally part of the landscape, if you know what I mean.) Scorsese and Coppola may have created an elegant modern mythos about mobsters, but in the 'burbs—where many of them lived—the reality was pretty banal: closer to Tony Soprano than Vito Corleone. I've always taken mob movies for what they are, entertainment, disconnected from reality; and *Mafia* (developed by Illusion and published by Gathering of Developers) simply expands upon that popular cliche.

It's a game that easily could have been more offensive than it is. Since the 1990s more game developers have been willing to leave behind the arena of fantasy violence and immerse players in the gritty, ugly world of modern urban crime. This isn't necessarily a good thing. The games themselves—such as the *Grand Theft Auto* or *Hitman* series—are often entertaining, but their content seems designed for maximum provocation, as if a company like Rockstar sees Congressional hearings as another advertising venue. That's not daring, it's simply irresponsible and unfair to an industry that now has to defend a game they might well find repellent.

*Grand Theft Auto 3* is an entertaining game, but it's easy to see why it would give parents the heebie-jeebies. "What are you playing, Junior?" "Oh, I'm just jackin' cars and slappin' round my ho. Get me a beer, biatch." Mom would break the land-speed record for letters to one's senator. The problem is the lack of a buffer between the content and the reality. Carjacking isn't really all that amusing in Jersey, where moms and old ladies in Newark are routinely dragged to their deaths by hopped up junkies boosting cars. Does *Grand Theft Auto 3* cause violent behavior? Of course not, but it makes it look cool and acceptable and fun, and that's not particularly helpful, is it?

*Mafia*, on the other hand, maintains that mythic, historical tone familiar from *Godfather II* and *Untouchables*. Set in the 1930s, the action is far enough removed from present reality to make it less grotesquely offensive than something like *State of Emergency*, a modern urban riot simulator. Before you start composing your e-mails, please get this straight: I'm not saying these things should be banned or regulated or anything like that. I'm saying there are some ways that are better than others for tackling this kind of material, and that's a creative choice. *Mafia* is a damn fine game. It's violent and amoral, but it maintains a high level of creativity. While its design owes a debt to *GTA3*, it isn't likely to wind up as exhibit A for Senator Lieberman. I guess that means Godgames will just have to buy ads like everyone else.

*Tom Halfhill was formerly a senior editor for* Byte *magazine and an analyst for* Microprocessor Report. *He is now a technical writer/analyst in Silicon Valley.*



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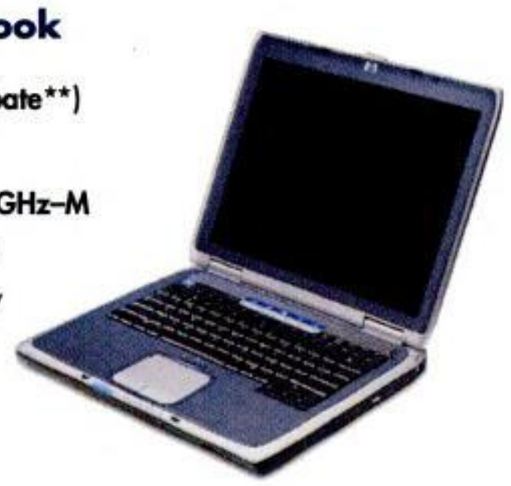

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# Head2Head

**A showdown among natural competitors**

## THIS MONTH: Hard Disk MP3 Players

Hard disk–based MP3 players have shrunk to manageable sizes, while capacities now dwarf anything you could find in a solid-state player. With support for playlists, ID3 tags, and multiple compressed-audio formats, they're God's gift to music lovers.

The ones we're reviewing this month, however, didn't come from heaven, but from Apple and Toshiba. Last year, Apple's iPod set a new standard for portable MP3 playback—not just in style, but also in ease-of-use, size, and sturdiness (and sturdiness is paramount considering how susceptible hard drives are to jostling). Now that Apple is offering a lighter, more capacious version of the iPod—a version with official support for Windows, no hacking necessary—we thought it would be a good time to take a second look.

Can Toshiba's Mobilphile give Apple a run for its money? Perhaps so, because after just one glance at the thing, we were enamored. Dig the soft metallic finish. Check out the trim design. And the internal hard drive is a standard Type II PC Card notebook drive! That's right: Just pop it out, and slip in another. Looks almost too good to be true.

Two contenders, but only one winner. Who's it gonna be?

**—LOGAN DECKER**

## APPLE iPOD

MAXIMUM PC KICK ASS PRODUCT

**Exterior:** From the nearly invisible sneeze-guard surface all the way down to the shiny metal base, the iPod is smaller, lighter, thinner, and prettier than the competition. And then there's the awesome jog dial: It glides under the lightest touch of a finger, but its slightly concave design isn't easily nudged by accident when it's stuffed in your pocket. **Winner: iPod** (though beauty is in the eye of the beholder)

**Storage:** With 20GB of storage, you don't have to be choosy about what you put on the iPod. Although the Mobilphile's 5GB hard drive can be swapped with another 5GB model, Type II PC Card hard drives are very expensive and not something you'll likely be collecting for your MP3 player. And how's this for irony: The manufacturer of the iPod's massive internal hard drive is... Toshiba! **Winner: iPod—by a mile**

**Transfer speed:** While FireWire has a technically slower transfer rate than USB 2.0, you'd never know it from this contest. Via its FireWire port, we loaded 4.6GB on the iPod in 23:57 (min:sec). That's almost seven minutes faster than the Mobilphile. The iPod also kindly informs you of unsupported types before you begin copying, and asks if you want to continue anyway. And the iPod smartly recharges through its FireWire cable—no adapter necessary. **Winner: iPod—by a mile**

**Navigation:** The iPod is a snap to navigate, especially because it never takes more than a few moments for the hard drive to spin up. There's no question that the iPod's menu system is intuitive and easy to use. It relies on ID3 tags, however, so if yours aren't in top shape, you could end up scrolling through a very long list trying to get to the song you want. **Winner: Mobilphile—by a hair**

**Sound quality:** When set completely flat, the iPod had a slightly brighter tone than the Mobilphile. It also offers 21 gentle EQ presets, and bundles a pair of good earbuds (although they still lack the bass response of Sony's $20 Groove MDR-ED228LP earbuds). The iPod gets blisteringly loud. **Winner: iPod**

**Software:** The iPod loads music through a custom, full version of *MusicMatch Jukebox 7.1*. You can either drag your files manually into the *Jukebox* window for uploading, or you can opt for automatic synchronization with your music library. The *Jukebox* interface may not be as elegant as Apple's own *iTunes*, but Apple deserves kudos for not skimping on a feature-restricted version, and at least it's not called "iTunes." **Winner: iPod**

**MAXIMUM PC VERDICT**

***iPOD***
APPLE

**www.apple.com**
**$500**

**9**



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# TOSHIBA MOBILPHILE

**Exterior:** The Mobilphile doesn't look as girly as the iPod, and the metallic finish is less prone to showing scratches and fingerprints. But while the Mobilphile design mimics the iPod's without copying it outright, Toshiba screwed up some important details. For example, what's the difference between the "Menu" and "Navi" buttons? You won't know until you try them. Also, the small icon at the bottom of the pad looks like a volume control, but it's not—it's actually EQ. The volume controls are on the side of the unit. And where the hell did the "e" in "mobile" go? **Winner: iPod**

**Storage:** You might think that having a 5GB PC Card hard drive that can be slipped into any compatible PC would give the Mobilphile an edge over the iPod, but don't get excited: The only way to load playable music files onto the Mobilphile drive is through Toshiba's bundled audio application, which automatically encrypts each audio file into its proprietary SAT format! Repeat: Any MP3s or audio files you load directly onto the drive (thus bypassing the audio software) won't play in the Mobilphile. **Winner: iPod**

**Transfer speed:** With encryption chores adding to its overhead, it took the Mobilphile 30:41 (min:sec) to load 4.6GB of music. Egad, that's almost 30 percent slower than the iPod! During its transfer process, the Mobilphile pops up a warning message whenever it runs into an unsupported file type—at, say, 20 minutes into copying when you've already wandered off in confidence that everything's OK. **Winner: iPod**

**Sound quality:** Although nearly on par with the iPod when running a flat sound, the Mobilphile offers just four types of EQ for audio seasoning—flat, bass, even more bass, and "loudness." The volume level has a high ceiling, but it can't compete with the glass-shattering iPod. The bundled earbuds are decent if you can live with the World's Shortest Headphone Cord. **Winner: iPod**

**Software:** Sorry to beat a dead horse here, folks, but we want to make sure it's dead. There's no reason to have your own music forcibly encrypted by the Mobilphile's audio software. It doesn't prevent users from using the removable hard drive to swap files (which is, of course, everyone's favorite way of trading copyrighted music—*not*), so what gives? So sad. Too bad. **Winner: iPod**

**Navigation:** Once you get past the horror of compulsory encryption, the Mobilphile player behaves just like you want it to: Drop a folder into the window, and everything is copied as is, nested folders and all. Not only are songs searchable by their ID3 tags, but you can also browse through them in the same directory structure that you have on your PC. However, delays when selecting or switching between menus can range from slightly less than a half-second to five seconds and sometimes more! **Winner: Mobilphile—by a hair**

**MAXIMUMPC VERDICT**

***Mobilephile***
TOSHIBA

**www.toshiba.com/tacp/**
**$500**

**5**

**Hard disk-based MP3 players may be state of the art, but we're not sure what to make of this haunting resemblance. At least we don't have to change the damn stylus anymore.**

## THE UPSHOT

Ouch! What can we say? Apple gave Toshiba a power-wedgie that won't soon be forgotten. The iPod has received a few tweaks here and there since its original release, but even the original would have humiliated the Mobilphile. We expected a better showing from Toshiba considering that the company has had such a long time to work out R&D since the debut of the iPod. Encrypting the audio tracks drastically slows upload times while offering no benefit to users whatsoever. Not even Triumph the Insult Comic Dog has anything to say about this.


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# WatchDog

Say hello to **Samson**, WatchDog of the Month.

**Maximum PC takes a bite out of bad gear**

## THIS MONTH: The WatchDog goes after...

**> ISP Billing Problems > Palm > Kodak > Nikon**

### ISP Billing Problems

**Have you ever looked closely at your credit card statement and found a debit from an ISP you've never used before? The Dog has not only heard about this from readers, but has experienced it himself as well. The problem seems to stem from massive consolidation in the Internet service provider market. For example, when a bankrupt company is swallowed up by a new company, the new ISP will bill the old customer even though that customer has never signed a contract with the new company nor used the defunct ISP in months. The Dog is conducting an informal survey of readers in an attempt to gauge the extent of the problem. Send your erroneous-billing experiences to the watchdog@maximumpc.com with the subject line: Bogus Billing. The Dog will report the results here and talk to the appropriate government agencies if a suspicious pattern is apparent. Woof.**

### Rebranded or Fake?

**DEAR DOG:** CompUSA ran a Labor Day sale which included a Pacific Digital Mach 48 48/12/48 CD-RW drive for a total of $49 ($69 less a $20 rebate). I thought if it didn't perform as well as a TDK, Plextor, or Lite-On drive, what the heck, it cost just $50 bucks. Well, it turns out, the label on the drive indicates that it's a Lite-On 48x. After I regained consciousness, I went to the Pacific Digital web site. When I clicked on the firmware upgrade, I was directed to the Lite-On web site. Do you think I got the genuine article?

**— DAVID KUPFERMAN**

**THE DOG RESPONDS: Good news, David, you actually received a genuine Lite-On CD-RW drive for just $49. Many small companies can't afford to manufacture their own components and instead repackage drives purchased from the large companies, such as Lite-On, Samsung, LG, etc. In your case, PD gave you a Lite-On drive—good for you. Even large companies such as TDK, HP, and Sony will sometimes turn to optical drive manufacturers for equipment. At one point, TDK used the same supplier as Plextor to construct its award-winning drives, and both HP and Sony repackaged the ill-fated Ricoh first-generation DVD+RW drive as their own.**

**This isn't to say that TDK, HP, et al. are simply buying drives and dropping them into their own boxes. Large companies often first have their own engineers test and certify the drives, and sometimes, the drives are actually manufactured to their specs. This benefits the consumer when potential problems are discovered and eliminated. On the flipside, it can be a hindrance to the customer: Some early Compaq PCs contained custom versions of Pioneer's DVD-R drive, which can't be updated with the firmware for the retail drive.**

**And in a final note to consumers: While PD used a Lite-On for the box that David bought, there's no guarantee that it will use Lite-On for all of its packages.**

**Many optical drive vendors simply remark hardware manufactured by other companies.**

### Palm Sued Over Colors; Offers Refunds

**Palm touted the M130's ability to display 65,000 colors, but it appears that no one at the company bothered to verify that claim. The Palm M130 can display just 58,621 colors, or 11 percent fewer colors than was stated in the original marketing collateral for the budget PDA.**

**Palm didn't exactly want to admit to the problem. Only after unsatisfied Palm M130 users began making noise did the company acknowledge that the PDA didn't meet its advertised specs. Although Palm finally issued an apology, company officials reportedly had no plans to make amends at first. And you can imagine where that was going.**

**It's taken a lawsuit and the wrath of customers to force Palm to offer refunds for the M130, which can't display 16-bit color.**

**Soon after Palm issued its public stance—"we're sorry, but them's the breaks," essentially—Philadelphia law firm Sheller, Ludwig & Badey filed suit against the company. (You may recognize the firm's name, as it's taken on Kenwood and Philips in the past, and is currently trying to force IBM to admit to a defect in its 75GXP hard drives.) The Palm suit alleges that while the company claimed the M130 had "more than 65,000 colors," it in fact does not. The suit was filed on behalf of Jonathan Lipner and Yansu Ouyang in Santa Clara County Superior Court, Calif.**

***"Although Palm finally issued an apology, company officials reportedly had no plans to make amends at first."***

**Soon after the suit was filed, Palm did an about-face and offered to give owners of the M130 a full refund or a free copy of *SimCity*, which is worth about $30. Palm owners interested in the refund or free game should visit www.palm.com/support/m130program/m130program.html. Those people who are still steamed that Palm tried to brush them off and are more interested in payback, should visit www.sheller.com/palmm130classaction.htm.**



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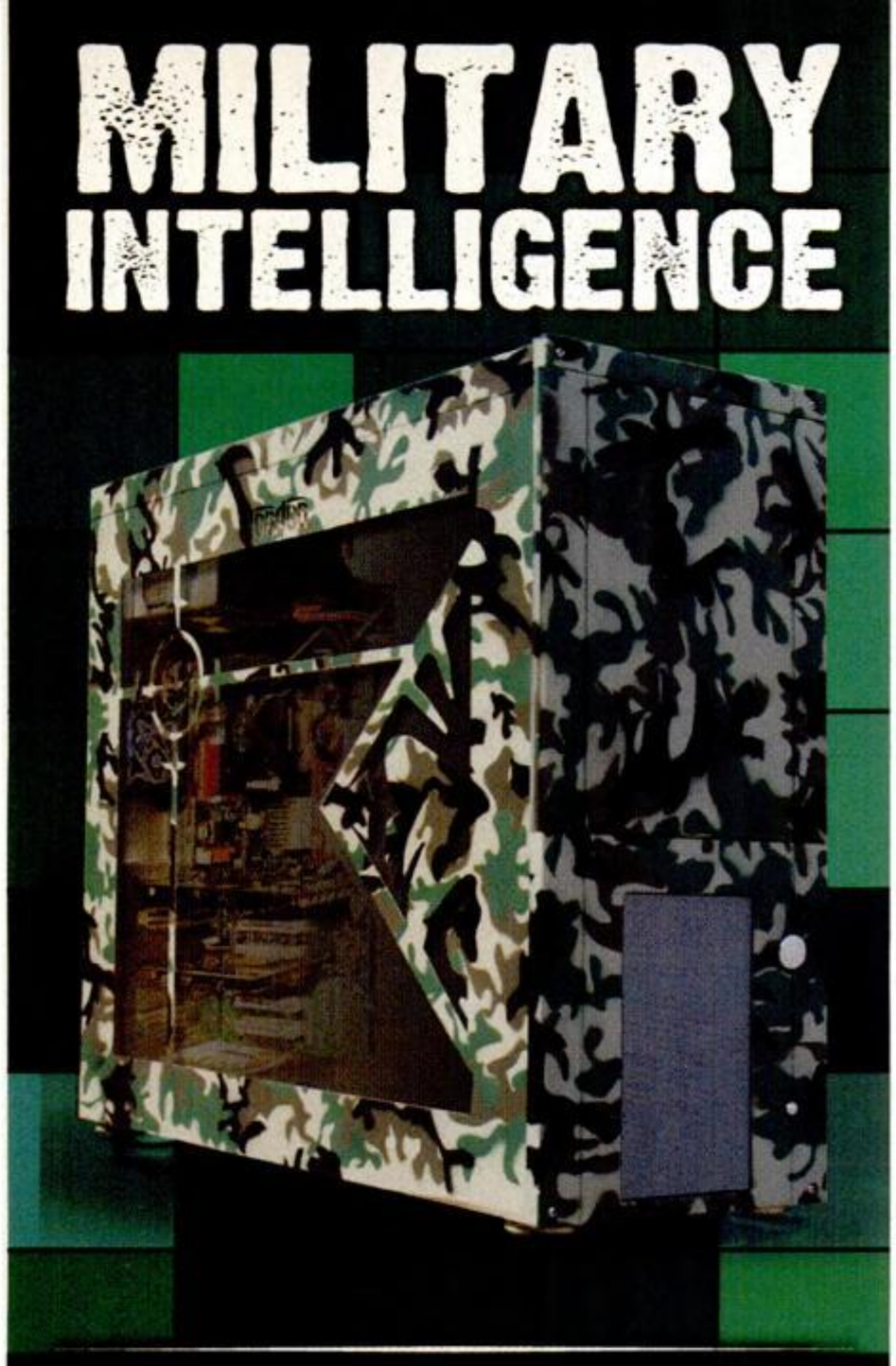


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# Consumer Advocate

## HP to Settle Suit Over Jamming Printers

Not to turn this column into an episode of Law and Order: Class Action Unit, but the Dog must mention that a suit regarding HP LaserJet printers is nearing an end. The suit filed last year in Middlesex County Superior Court in New Jersey alleged that the following models had multifeeding and jamming problems: LaserJet 1100, 1100SE, 1100E, 1100A, 5L, 6L, 3100, and 3150 manufactured between Sept. 1, 1995 and June 30, 2000. A settlement entitles owners of those printers to a rebate. The rebates range from $70 to $20, with the higher rebates going to people who can prove they own one of the printers and paid to have the problem fixed.

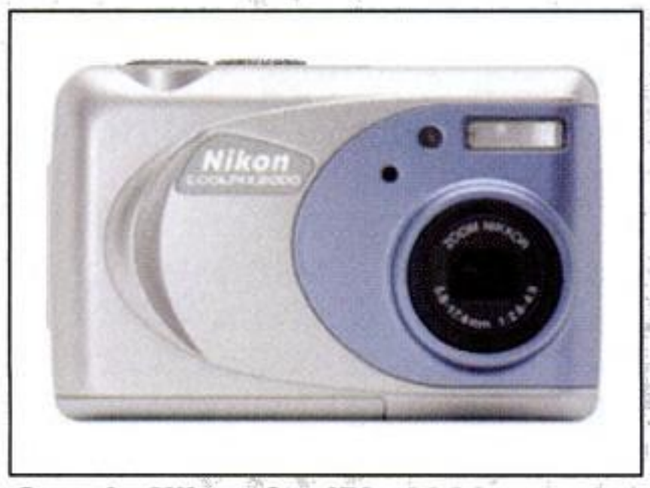
Certain printers, such as the 6L, 3100, 3150, and 1100, may also receive a repair kit to fix the jamming problems in those printers. (A fix proposed on the Internet for those people who can't repair their printers is to keep the paper reservoir well below the two-thirds maximum capacity.) For more information on the suit, visit http://laserjet.classaction.hp.young-america.com or contact the claims administrator at 866.852.8620. While owners of the printers don't seem to be getting much compensation for the problem, the attorneys in the case have carved out a nice deal for themselves. If approved by the court, HP could pay the attorneys some $3.5 million. Woof. ■

## RECALL ALERT

If you don't get shocked, you might get burned

Kodak is recalling some 75,000 digital cameras because of a potential shock hazard posed by its DC5000 model. Kodak has asked that consumers immediately stop using the camera and return it to the company. The recall is voluntary, but Kodak is cooperating with the U.S. Consumer Product Safety Commission. Twelve consumers have reported being shocked by the camera while changing batteries, or while installing or removing the memory card or USB cable. None of the injuries have been serious. To see if your DC5000 is affected, look on the bottom of the camera for a metal plate bearing a product ID of KJCAA and an eight-digit serial number. The cameras with the manufacturing defect range from 01800001 through 11700825. The cameras were sold in stores as well as online and via mail-order from June 2002 until August 2002. Kodak is not offering a refund or replacement model; the company will inspect and repair any defective cameras. Kodak won't say how long a returned camera will be out of the consumer's hands. More information is available at www.kodak.com or by calling 888.793.2977 between 9 a.m. and 8 p.m. eastern time, Monday through Friday.

Instead of providing a Kodak moment, some DC5000 cameras can shock their owners.




Certain Nikon CoolPix 2000s may overheat and burn fingers.

Kodak isn't the only camera company with problems this month. Nikon has also issued a voluntary recall of certain CoolPix 2000 digital cameras. Nikon says some CoolPix 2000 cameras may short circuit in the battery compartment and burn consumers' hands. Nikon says it has received complaints of injuries but none in the United States. The recall affects cameras with serial numbers 3010001–3060980, and 3510001–3561916 (see the underside of the camera). If your camera is within the affected serial range, Nikon wants you to immediately stop using the camera and remove the batteries. If you have one of the recalled cameras, Nikon says it will replace the camera with a new CoolPix 2000 that has been redesigned. Contact Nikon's customer service at 800.645.6687 or visit www.nikon.com for more information.

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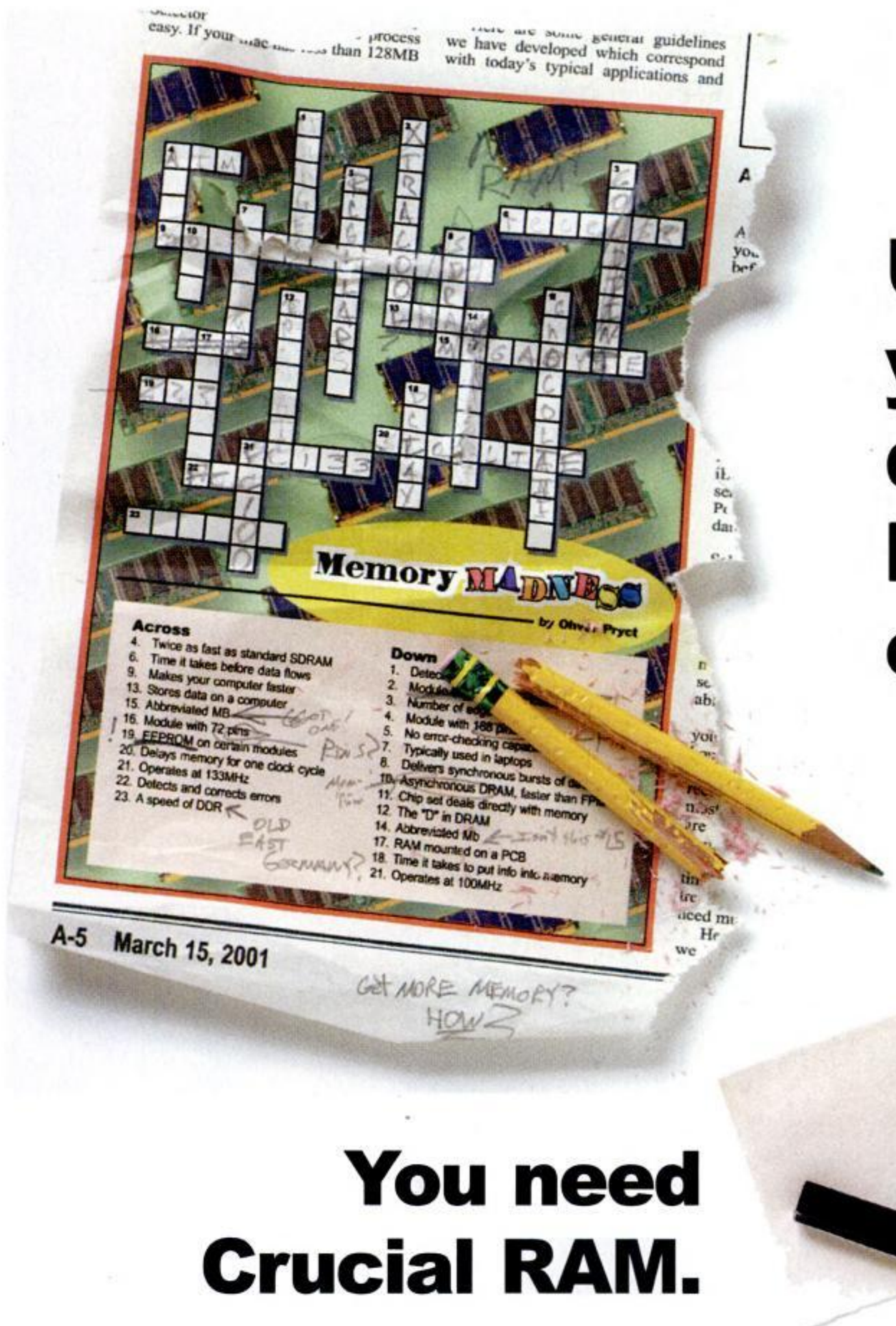
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6. Time it takes before data flows
9. Makes your computer faster
13. Stores data on a computer
15. Abbreviated MB
16. Module with 72 pins
19. EEPROM on certain modules
20. Delays memory for one clock cycle
21. Operates at 133MHz
22. Detects and corrects errors
23. A speed of DDR
Down
1. Detec
2. Module
3. Number of
4. Module with 168
5. No error-checking capab
7. Typically used in laptops
8. Delivers synchronous bursts of
10. Asynchronous DRAM, faster than FP
11. Chip set deals directly with memory
12. The "D" in DRAM
14. Abbreviated Mb
17. RAM mounted on a PCB
18. Time it takes to put info into memory
21. Operates at 100MHz
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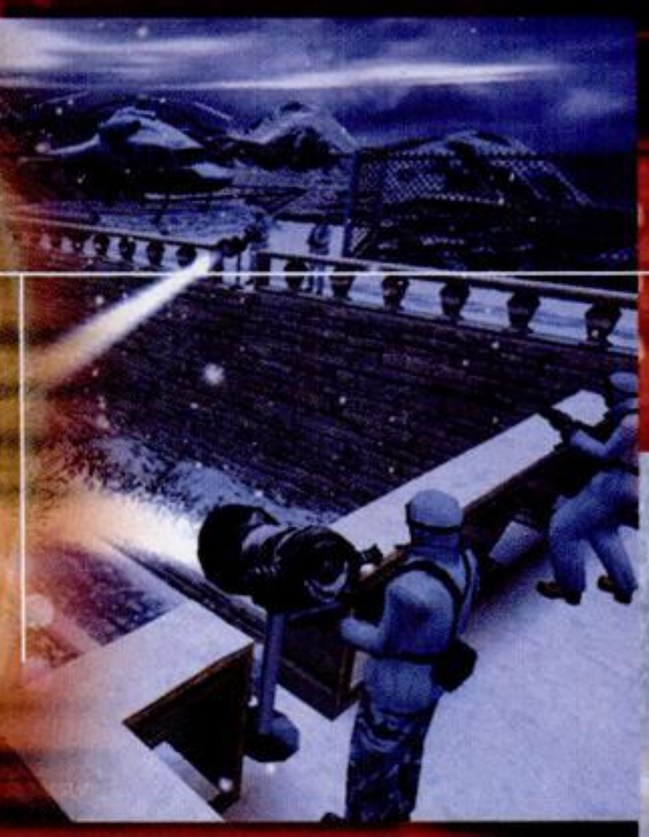

You'll need gadgets, lots of gadgets, gadgets to master the art of becoming invisible, infrared goggles to start, maybe a grappling hook

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CONTENT RATED BY ESRB

Violence
Suggestive Themes

PC
CD ROM

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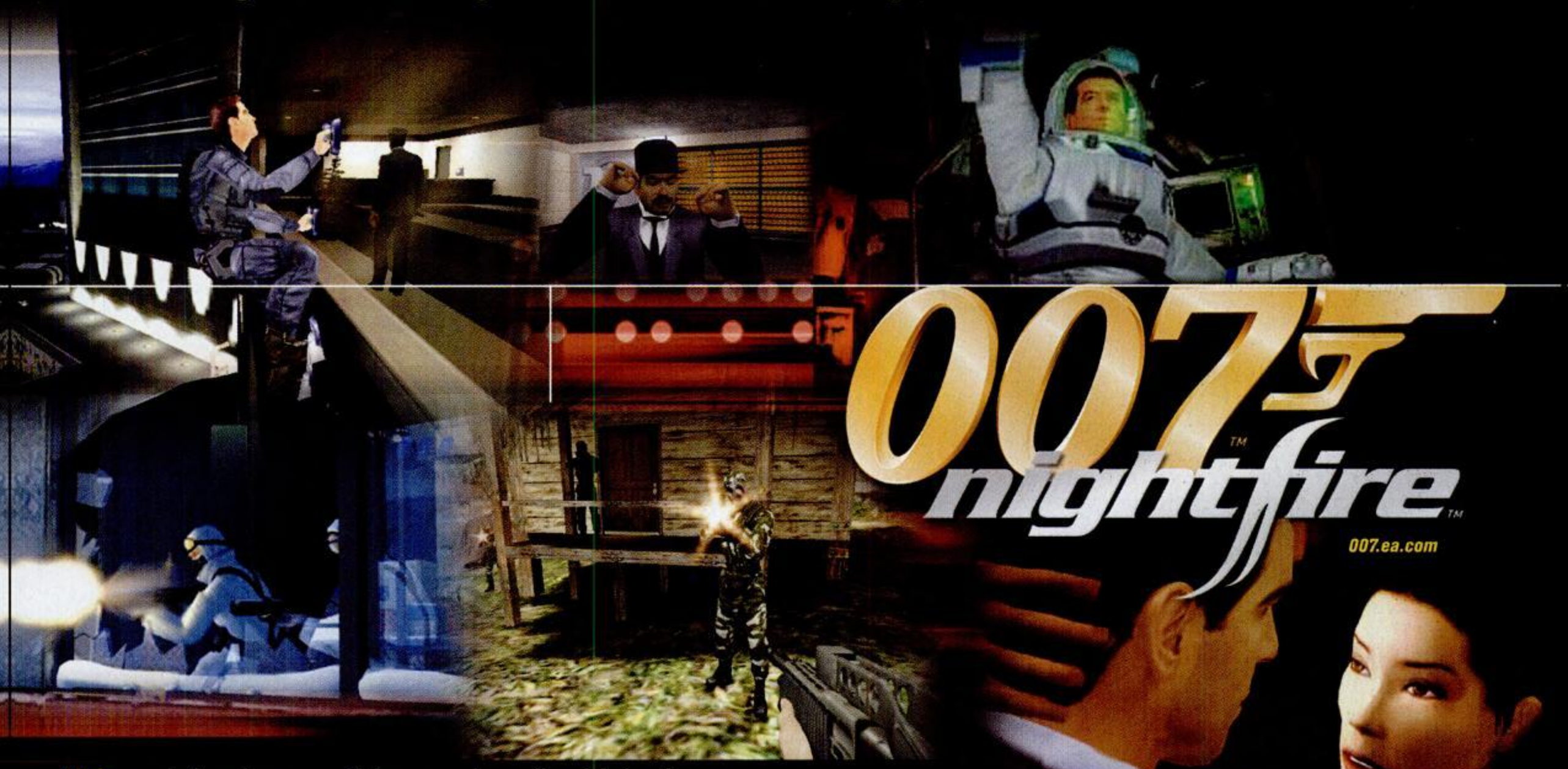


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# A SIGHT TO 'B' HOLD!

**AMD unleashes an armada of Revision 'B' Thoroughbreds to attack Intel where it hurts. Can a faster system bus and core frequencies overtake the Pentium 4? Only our benchmarks will tell...**

BY GORDON MAH UNG

Get it straight: Megahertz doesn't matter—but gigahertz does. And it was a 2GHz wall that AMD crashed into this June. While Intel's Pentium 4 was pushing 2.5GHz and sporting a brutally fat 533MHz frontside bus, the AMD Athlon XP was stuck at 1.8GHz (performance rated at 2200+) and getting toasted by the P4 in many key benchmarks. Sure, AMD was manufacturing the Athlon XP on a 0.13-micron process, but the 2200+ offered a mere 66MHz frequency increase over the previously released Athlon XP, and still ran on a 266MHz bus.

By late August, Intel had dialed up the P4 to 2.8GHz, and many pundits—including *Maximum PC* editors—had written off the Athlon XP for good. The fastest XP chip was getting trounced in benchmark battles with the fastest P4, and most hardcore PC enthusiasts (save diehard AMD fan boys) were waiting for AMD's Barton and Hammer processors to propel the "other" chip company back to dominance. If a leapfrog maneuver over the P4 was in the works, it certainly wouldn't be coming from the Thoroughbred version of the Athlon XP, which appeared to have reached a frequency, if not performance, ceiling.

But just when everyone thought the XP was on its way to becoming a museum piece, someone on the AMD bridge called up the engineering room and cried, "Get Athlon XP more power, or we're dead!"

As it turns out, the engineers *were* able to meet the challenge, and the result is the latest AMD onslaught—an armada of four new processors that are lobbing warning shots across Intel's bow. The fleet includes the 2400+ and 2600+ on the low end, and the 2700+ and 2800+ at the top of the line. The chips run at 2GHz, 2.13GHz, 2.17GHz, and 2.25GHz, respectively, and the two fastest procs ride a brand-spanking new 333MHz bus.

Does the 2800+ have enough juice to goose the fastest P4? You'll know soon enough. Read on for the full FAQ on AMD's latest processors, as well as our analysis of how the 2800+ compares to the 2.8GHz P4.



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## KEY SPECIFICATIONS

| | | | |
|---|---|---|---|
| NAME | Athlon XP 2800+ | PROCESS | 0.13-micron |
| FREQUENCY | 2.25GHz | TRANSISTOR COUNT | 37.6 million |
| BUS SPEED | 333MHz (166MHz double-pumped) | INFRASTRUCTURE | Socket A |
| L1 CACHE | 128KB | CORE VOLTAGE | 1.65 volts |
| L2 CACHE | 256KB | MAX DIE TEMPERATURE | 85°C |
| DIE SIZE | 84mm$^2$ | MAX THERMAL POWER | 68.3 (62 watts typical) |


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# AMD STRIKES BACK

## How was AMD able to hit 2.25GHz after months of futility?

AMD achieved its newfound speed by adding a layer to the CPU core (the core is the fingernail-size sliver of metal in the middle of each Athlon XP; it shouldn't be confused with the brown or green substrate surface around the chip). In specific terms, the number of metal layers in the Athlon XP core was increased from eight to nine. The extra layer helped reduce the electrical noise and congestion that was preventing AMD from coaxing more speed from the core architecture.

Confused? Then think of the Athlon XP core as a metropolitan freeway maze where lanes criss-cross each other at different heights. The XP's core had hit gridlock, but by adding the additional layer and routing traffic *above* the fray, AMD was able to ease the congestion and gain as much as 400MHz.

The nine-layer version of the Athlon XP core is called Thoroughbred B, while the original core is now referred to as Thoroughbred A.

## Doesn't the extra layer increase complexity and cost?

Yes and no. The additional layer adds about 400,000 transistors to the chip and increases the height just a tad, but AMD says Rev B doesn't cost any more to produce. Because the chip has essentially been built "up" instead of "out," its small die size still grants a significant cost savings over the P4. To wit: Intel's current Pentium 4B has 55 million transistors, measures about 131mm², and is built with six layers. AMD's latest Athlon XPs, meanwhile, have 37.6 million transistors, measure a dainty 84mm², and have nine layers.

The detail-oriented among us will note that Thoroughbred Rev B is 4mm² larger than Rev A. Nonetheless, Mark de Frere, AMD's Athlon brand manager, says that even with the slightly larger die size, AMD still gets to enjoy its previous dies-per-wafer efficiency. "Four millimeters won't kill you," says de Frere.

## Why didn't AMD do this engineering on the first Thoroughbred?

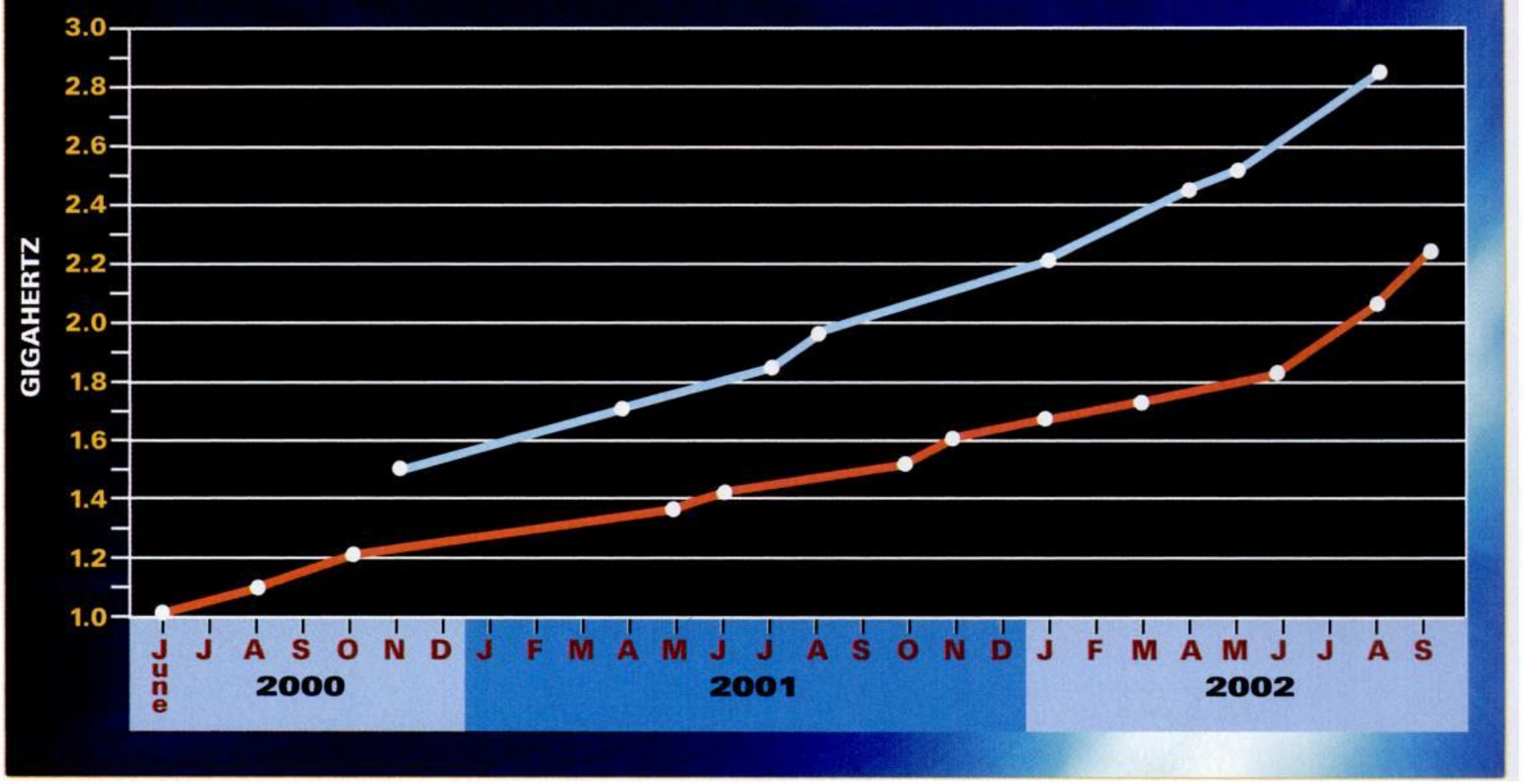
When CPU companies move to a new process, they generally try to keep things safe and simple. In the words of an AMD rep, "If you try to add too many features and too many metal layers, there are too many variables." So both AMD and Intel usually release a new process technology, wait to see if any problems arise, then tidy things up once they're confident that a basic design works. Take, for example, the Pentium 4. The initial Northwood P4 measured 146mm², but Intel later shrank it to 131mm² by cleaning up circuit layouts and tightening the design. Bottom line: Some engineering is best executed after a significant amount of silicon has been produced.

## Seeing as how the Thoroughbred needed "cleaning up," should we all start worrying about the integrity of the earlier A versions?

## THE MARCH TO 3GHZ

**AMD trounced Intel in June 2000 when it pushed the classic Athlon to the historic 1GHz mark. Since then, however, the two companies have been locked in a bitter battle, with Intel gaining the upper hand (in clock speeds, at least) once it released the Pentium 4. To give you some perspective on the race to the 3GHz finish line, we dug into our archives to track just who launched what.**

**Because CPU companies often introduce a number of new speed grades on the same day, we opted to note only the *highest* speed grades offered in any group announcement. Also, please note that all AMD Athlon XPs are referred to by their performance ratings. For example, the 2800+ runs at 2.25GHz.**




**Intel notes:** The basic P4 scaled from 1.5GHz to 2GHz. The P4A scaled from 2.2GHz to 2.6GHz. The P4B started at 2.53GHz and is still on the march. **AMD notes:** The basic Athlon scaled from 1GHz to 1.4GHz. The Athlon XP was launched at speeds ranging from 1.33GHz to 1.53GHz and is still on the march.



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# AMD STRIKES BACK

There's absolutely nothing wrong with the 2200+ processor, or any other chip using the Thoroughbred A core. AMD says the first-gen Athlon XPs can run a full life clocked at 1.8GHz or lower. For overclocking, however, the Thoroughbred A isn't the optimal candidate. AMD says that once the existing inventory of Thoroughbred A cores is vanquished, all Athlon XPs will feature the new core.

## I want to overclock, so how do I know if I have a Rev A or Rev B?

The two chips look almost exactly the same. The B version is imperceptibly taller than the A version, and AMD says it'll be difficult to determine which is which. So if you want a B version, you must either buy a 2400+ or faster CPU, or wait long enough for all the A versions to sell out.

## What about the bus, man? What about the freaking bus?

Both the 2700+ and 2800+ usher in 166MHz DDR, which translates into a 333MHz system bus. AMD says it gets about a 28.5 percent increase in peak data throughput from the upgrade. The new bus speed also perfectly matches the DDR333 memory that's being used in most high-end Athlon systems. Now, a lot of naysayers will say "big whoop." Indeed, overclockers have been running Athlon XPs on a 333MHz bus for quite a while. But AMD says there's a big difference between squeezing out 333MHz during random overclocking escapades and actually manufacturing 100,000 CPUs and corresponding core-logic chipsets that are guaranteed to run a 333MHz bus. AMD says "a lot of hard work" was required to get the new CPU/chipset platform to work with acceptable reliability, and the company needed time to work with chipset and motherboard vendors to validate the bus speed.

Remember, we're not talking about increasing the internal speed of the chip. We're talking about upping the speed of a complex, 64-bit, point-to-point motherboard channel, then creating specs and directions so motherboard manufacturers can reliably implement the technology on their own. To put this all in perspective, consider that it took Intel more than a year to increase the frontside bus of the Pentium 4 from 400MHz to 533MHz (that's 100MHz to 133MHz, quad-pumped).

## Will I be able to use a 333MHz FSB Athlon XP in my motherboard if the board's bus isn't designed to run at 333MHz?

AMD doesn't recommend that you use a 2700+ or 2800+ Athlon XP in a board unless the motherboard maker says you can. At press time, only the nVidia nForce2 and VIA KT400 chipsets were ready to run the faster bus speeds, so if you want to clock any other chipset up to 166MHz double-pumped, proceed with caution.

## Would running DDR400 memory on the new 333MHz bus provide any benefits?

It's unlikely that you'd see any performance benefits from running DDR400 on a mismatched bus. Dig: When we asked AMD to send us a test system for this article, they pointed us straight to Voodoo PC, which is one of the major OEM players in the Revision B rollout. Voodoo was intent on configuring the absolute fastest performer possible, and opted for DDR333 with a CAS latency of CL2 instead of DDR400 with a latency of CL2.5. Moral of the story: For DDR400 to offer any tangible speed benefits, you'll need to match it with a 400MHz bus (how you get there is your own damn business).

## Bus speeds aside, will the new 2700+ and 2800+ chips work in mobos designed for earlier Athlon XPs?

Depends. The Thoroughbred Bs run at about 1.65 volts. If your motherboard's voltage regulator doesn't support this amount of voltage, or if the BIOS rejects the unrecognized CPU string, you may have problems. As always, consult your motherboard vendor for guidance before plunking down money on a new chip.

## How can AMD award 100 more performance points if the 2700+ is clocked only about 40MHz faster than the 2600+?

The 2600+ runs on the old bus, while the 2700+ runs on the new bus. AMD says the bus increase gives the processor enough of a kick-start to warrant the full 100 point rating jump. Regardless, we're still none to fond of the entire performance rating concept. It was established when AMD rated its 1.53GHz Palomino Athlon as a 2000+, and this CPU was easily competitive with a 2GHz P4. But over time, subsequent AMD procs haven't necessarily scaled with their Intel counterparts.

## What happened to the CPU code-named Barton?

Online scuttlebutt had it that AMD would be introducing an Athlon XP with 512K of on-die L2 cache (aka Barton) in October. These rumors were false. AMD's only plans for October were to introduce the 2700+ and 2800+ with faster system bus support. In fact, AMD has pushed the release of Barton back until the first quarter of next year because it believes it can obtain much more speed and performance from the Thoroughbred B core. Barton's larger L2 is expected to give the Athlon XP even more performance but you'll have to wait three months or more. For that matter, you might as well wait for Hammer. And then you might as well wait for Hammer XP. See the dilemma?

## Will I be able to run Barton on my old motherboard running a 266MHz bus?

That's unknown. Because Barton will almost certainly require a BIOS flash to support the larger L2, your motherboard vendor will have to either release a new BIOS or bail on you completely. Barton will come in only 333MHz versions, so if you don't want to deal with unlocking the chip's multiplier, you should just buy a new motherboard. As always, check with your motherboard vendor for support.

## Why did you test the new Athlon XP 2800+ in a PC from Voodoo?

**Our 2800+ came preinstalled in this Voodoo PC rig, which AMD considers to be the equivalent of a reference box.**



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# AMD STRIKES BACK

AMD's supply of 2800+ processors was extremely tight when we received the Voodoo system for testing in early September. Tight, in fact, to the tune of one chip per planet (planet Earth, in our case). At least, that's what AMD told us. Apparently, if we wanted a chip sitting in an AMD-built reference system, or even a free-range chip that we could pair with our own motherboard, we wouldn't have received anything, and you wouldn't be reading this article.

So AMD had us call Voodoo PC, which configured a test system based on the 2800+ and an MSI KT400 motherboard running the VIA KT400 chipset. Instead of running Serial ATA or RAID (which the board supports), Voodoo PC dropped in a single Western Digital WD1200JB drive so we could easily and quickly prepare a similar configuration to represent the P4 during comparative testing.

## Short supply of 2800+ CPUs? Does this mean the fastest procs will be impossible to find?

The 2800+ versions will go to top OEMs first, and to second-tier vendors second. You'd be hard-pressed to find a 2800+ right when the CPU launches, but by the time enough web site buzz has convinced you to throw down, you should be able to buy one online.

## How much further will the Athlon XP scale?

Athlon Brand Manager de Frere says that overclocking reports published online point to the frequency headroom of the Revision B technology: "If overclockers can do it today, then we can do it in manufacturing, absolutely." AMD wouldn't comment on future speeds, but early indications show that the slower-marked versions of Thoroughbred B can easily surpass 2.5GHz with proper cooling.

## What's next? Faster Athlons or straight to Hammer?

In the coming months you should see faster versions of the 256K L2 cache Athlon XP, and then, by next year, the XPs should segue to Barton.

Hammer is still set for a launch early next year, with speeds greater than 2GHz. AMD says Barton and Hammer will coexist, but for just how long, we have to wonder. The company says basic 32-bit Hammer performance will probably exceed that of the fastest Athlon XPs, so we suspect that AMD's focus will shift to Hammer sooner rather than later.

## And what's next from Intel?

Expect a 3GHz P4 with HyperThreading enabled by the end of this year. Intel has also already demo'd a supercooled P4 pushing 4.7GHz—so that should tell you something about the P4's lifespan. Also, in 2003, Intel should have P4s on new 90nanometer (0.09-micron) process. With the new process, Intel is expected to increase its transistor count several fold and use the added circuits for an L2 as large as 1MB. Internet rumors say a new instruction set dubbed PNI is also on the way.

This battle is far from over.

## ATHLON XP DECODER RING

**Can't figure out what the heck a 2400+ is? Then use our handy-dandy decoding chart to help you wade through AMD's mystifying model classifications.**

| MODEL NAME | CLOCK SPEED | BUS SPEED | PROCESS | CODE-NAME |
|---|---|---|---|---|
| Athlon XP model 2800+ | 2.25GHz | 333MHz | 0.13 | Thoroughbred B |
| Athlon XP model 2700+ | 2.17GHz | 333MHz | 0.13 | Thoroughbred B |
| Athlon XP model 2600+ | 2.13GHz | 266MHz | 0.13 | Thoroughbred B |
| Athlon XP model 2400+ | 2GHz | 266MHz | 0.13 | Thoroughbred B |
| Athlon XP model 2200+ | 1.8GHz | 266MHz | 0.13 | Thoroughbred A |
| Athlon XP model 2100+ | 1.73GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 2000+ | 1.67GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 1900+ | 1.6GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 1800+ | 1.53GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 1700+ | 1.47GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 1600+ | 1.4GHz | 266MHz | 0.18 | Palomino* |
| Athlon XP model 1500+ | 1.33GHz | 266MHz | 0.18 | Palomino* |

*Eventually all Athlon XPs will use the improved Thoroughbred B process.



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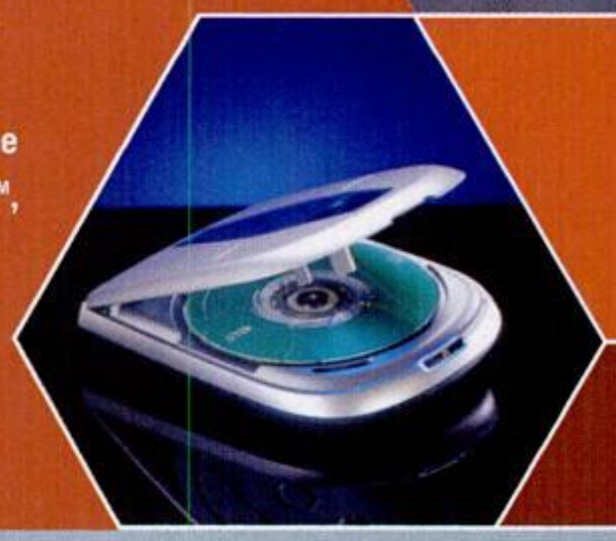

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# Showdown at 2800—Or Is That 2.8GHz?

## Let's see how AMD's fastest Athlon XP compares to the speediest P4

And now we come to the question everyone's been waiting for: Which company has the highest performing desktop proc, AMD or Intel?

### The Platforms

AMD's best effort was represented by the system provided by Voodoo PC. It included an Athlon XP 2800+ (2.25GHz), the new MSI KT400 motherboard, 512MB of DDR333 (CAS2), an ATI Radeon 9700 Pro videocard (clocked at stock settings), and a single Western Digital WD1200JB hard drive.

We did our best to build a comparable Intel box—a rig that would help us isolate CPU and bus performance when comparing the fastest iterations of the competing processor platforms. The following config suits the bill nicely: a 2.8GHz P4, an Intel D850emv2 motherboard, 512MB of PC1066 RDRAM (32ns), an ATI Radeon 9700 Pro videocard (clocked at stock settings), and a single Western Digital WD1200JB hard drive. For both platforms we used Windows XP Home and the same build of videocard drivers.

AMD suggested that we compare its 2800+ to a P4 running DDR SDRAM, because that's what most people are buying with P4 systems. We ignored the request because we wanted to see what kind of scores we could get from each platform's best configuration. Besides, we doubt that any 2.8GHz P4 buyers are using DDR.

That said, we were interested in the relative efficiency of each CPU's core architecture, so we also ran benchmarks with an unlocked, underclocked P4 set to 2.26GHz (17x133MHz)—essentially the same clock frequency used by AMD's 2800+.

If you're in the Intel camp and want to cry foul, please note that we also ran our P4 chip at 3.05GHz (23x133MHz) to see how the 2800+ would fare against faster Intel silicon that will be released later this year. (Note: When 3GHz P4s do hit market, they'll feature improved HyperThreading. Obviously, our overclocked 2.8GHz doesn't boast this performance boost.)

### The Benchmarks

AMD has been complaining that *SYSmark2002* is heavily weighted to favor the P4, so we decided to complement the controversial BAPCo benchmark (see page 12) with an avalanche of other real-world tests, figuring that the sheer comprehensiveness of our Lab procedures would lead us to conclusive evidence. Here's a rundown of our battery of benchmarks:

- From our standard suite of system tests: *SYSmark2002, Adobe Premiere 6.0,* and *MusicMatch 7.1.*
- We also ran updated versions of *Premiere* and *MusicMatch* (*6.5* and *7.2*, respectively) to see just how the applications themselves hook into the different CPU architectures.
- From the pool of benchmarks we've historically used for isolated CPU testing: *SETI@home, Adobe Photoshop 7.0, Discreet Cleaner 5,* and *Newtek Lightwave 7.5.*
- To the test the CPUs' performance during 3D gameplay, we used *Jedi Outcast* (1280x1024), *Quake III* (640x480), *Commanche 4* (1024x768), and the patched version of *3DMark2001 SE*. Audio was turned off for each test.
- To gauge system bus bandwidth in addition to raw CPU speed, we grabbed SiSoft *Sandra 2002* and *SPECviewperf 7.* The individual 3D workstation benchmarks in *SPECviewperf are* designed to mostly measure OpenGL performance, but they can also be a good gauge of overall system performance.
- Finally, because AMD has raised holy hell over alleged bias in *SYSmark2002*, we reached into the drawer for *SYSmark2001*; this earlier version of the BAPCo benchmark actually favored AMD when the company initially released the Athlon architecture. We ran *SYSmark2001* both patched and unpatched. The patch was created by AMD, and it allows the *Windows Media Encoder* portion of the benchmark suite to take advantage of the Athlon XP's SSE instructions.

### The Upshot

We wanted to determine three things during analysis: (1) Which company offers the highest performing desktop platform, clock speeds notwithstanding; (2) which company offers the most efficient core architecture; and (3) which company offers the most value.

We won't keep you on pins and needles. After running all our benchmarks, we found an overwhelming amount of wins in the Intel columns—AMD has made strides with its new core frequency and system bus, but it hasn't overtaken Intel quite yet (at least in respect to the 2800+ vs. P4 2.8GHz battle). Here are some highlights of the "clock speeds notwithstanding" battle:

- In *MusicMatch*, where Intel has traditionally triumphed, the 2.8GHz P4 held just a 6 percent lead over the 2800+. Updating the code to 7.2 made little difference, save for shaving overall time—the P4 was still 6 percent faster. A statistically insignificant victory for the P4, one might argue, and quite a good showing for the Athlon XP, considering its massive clock speed handicap.
- The Athlon has always kicked butt in *Premiere 6.01*, and continued to do so at 2800+ with a 30 percent lead. In fact, even when we overclocked the P4 to 3GHz and had it run the updated, more Intel-friendly *Premiere 6.5* code, the Athlon XP still muscled past the P4. There's no contest here. If you use *Premiere*, dump your P4 box for an Athlon XP box.
- There was more good news for the Athlon in *SoundForge 6.0*. Here we time how long it takes to resample a 48KHz file down to 44.1KHz. While this benchmark is heavily disk-dependent and suffers a greater margin of error than other benchmarks, the Athlon XP still proved who's boss, to the tune of 23 percent better performance.
- The worm turned in our gaming benchmarks. The 2.8GHz P4 schooled the 2800+ in *Quake III Arena* and *Jedi Outcast* with 28 percent and 13 percent more performance, respectively. The P4 also ran *Commanche 4* about 10 percent faster than the Athlon XP. In fact, in our gaming benchmarks, the 2800+ only closed the gap in *3DMark2001* SE, where the 2.8GHz P4 was just a scant 3.5 percent faster.
- Under *SPECviewperf 7,* the P4 handily defeated the Athlon XP in every single test. This surprised us, because we've seen the Athlon win some of the *SPECviewperf* tests before. Of course, that was with an older version of *SPECviewperf*, and against a slower P4. It appears the P4 has closed the gap.
- In *SYSmark2002*, the P4 turned in an overall score that trounced the 2800+ by 21 percent. It's no wonder AMD is complaining so loudly!
- The real surprise came when we saw the *SYSmark2001* results. In light of the Athlon architecture's historically strong performance in this benchmark, and the fact that AMD was calling its fastest CPU a "2800+," we expected the Athlon XP to sock the P4 in the tummy. But, surprisingly, the P4 beat the Athlon XP even when the benchmark was running the AMD-created patch to enable SSE for *Windows Media Encoder.*

AMD's victory, we suppose, is that the 2.8GHz P4 performed only about 6 percent faster than the 2800+ (without the AMD patch, the P4 was roughly 12 percent faster). We'd say that 6 percent is well within striking distance, and it'll be interesting to see what happens when Barton arrives.

### Same Frequency, Different Story

So what happens when you compare a 2.25GHz Athlon XP running DDR333 on a 333MHz bus to a 2.26GHz P4 running PC1066 on a 533MHz bus? Pretty much what you'd expect: The Athlon schools the similarly clocked Intel processor, the P4's extra memory bandwidth notwithstanding. Granted, the Athlon didn't outperform the P4 in every category, but it did so in enough benchmarks to prove that the Athlon XP architecture is more efficient, clock cycle for clock cycle.

There you have it: The "megahertz myth" has been proved. To an extent.

The problem, of course, is that even with its



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significant efficiency advantage, the 2.25GHz Athlon XP can't beat the 2.8GHz P4. This is a bit of a letdown considering that this fastest Athlon is rated as a 2800+. We think that AMD should have either revised its performance ratings (an unseemly proposition considering that the genie has already been let out of the bottle), or come out with an even higher-clocked CPU to compete with Intel's 2.8GHz P4.

As for the "megahertz myth," we must note that Intel supporters say the entire argument is inverted to favor the Athlon XP. To wit: Why must a testing organization clock down the P4 to match the speed of the Athlon XP? Why not clock *up* the Athlon to match the fastest P4?

Well, the answer, of course, is that AMD doesn't yet feel comfortable bringing Thoroughbred Revision B to 2.8GHz (at least not across a whole production line). And that, in a nutshell, is the point of Intel fan boys: The Athlon XP might be efficient, but its basic architecture just doesn't have much frequency headroom left, and this is a serious problem.

For consumers, it really comes down to what kind of engine you're looking to run. The P4 is akin to a small block V12: It may not have the raw brute torque and low-end of a big cube engine, but its higher RPM and distribution through the power band pulls all the way to the redline of 2.8GHz.

Following the same analogy, the Athlon XP engine is heavy metal—a 454-cuber that rips the tires loose and throws you through the quarter mile. At high-RPMs, it runs out of steam, however. It's pure floating-point torque rips through some apps (such as *Photoshop* and *Premiere*) in nothing flat. In other apps, though, the XP's lack of top-end hurts.

## But What's the Best Value?

*Maximum PC* has always awarded its highest praise to the best-performing products, prices be damned. That's why we've been favoring the P4 for about half a year now. But we'll be the first to declare that, in general, AMD has always offered more performance for the money than Intel. The price differential between AMD and Intel processors is closing, however, and Intel is looking prettier than before.

The new Athlon XP 2800+ is likely to sell at $400 when purchased in quantities of 1,000. At press time, the 2.8GHz Pentium 4 was selling for $508 per CPU in lots of 1,000. That's about 25 percent more expensive than the fastest Athlon XP, but it still represents a price drop for Intel, considering the 2.53GHz P4 was selling for $637 at one time.

In *SYSmark2002*, the Athlon XP trailed the P4 by about 20 percent—this almost renders moot its 25 percent pricing advantage. In the patched version of *SYSmark2001*, the Athlon XP trailed the P4 by just about 5 percent—not bad for a CPU that will likely cost $100 less. Our other benchmarks tell similar stories. The 2800+ might not outperform the P4, but it still offers the most performance for every dollar spent. ■

# AMD vs Intel: Dare to Compare

| CPU Clock Speed | Athlon 2800+ 2.25GHz | Pentium 4 2.8GHz | Pentium 4 2.26GHz | Pentium 4 3.05GHz |
|---|---|---|---|---|
| SYSmark2001 Overall | 244 | **274** | 236 | WNR |
| SYSmark2001Content Creation | 246 | **297** | 255 | WNR |
| SYSmark2001 Office Productivity | 243 | **253** | 218 | WNR |
| SYSmark2001 Patched Overall | 259 | **274** | 236 | WNR |
| SYSmark2001 Patched Content | 279 | **297** | 255 | WNR |
| SYSmark2001 Patched Office | 241 | **253** | 218 | WNR |
| SYSmark2002 Overall | 221 | **268** | 233 | 283 |
| SYSmark2002 Content Creation | 270 | **358** | 315 | 399 |
| SYSmark2002 Office Productivity | 181 | **201** | 173 | 201 |
| Lightwave 7.5 Raytrace | 134 sec. | **109.4 sec.** | 134.5 sec. | 99.8 sec. |
| Lightwave 7.5 Radiosity | 90.9 sec. | **53.3 sec.** | 64.5 sec. | 48.5 sec. |
| Photoshop 7.0 | **33 sec.** | 35 sec. | 47 sec. | 32 sec. |
| Premiere 6.0 | **296 sec.** | 384 sec. | 472 sec. | 363 sec. |
| Premiere 6.5 | **263 sec.** | 294 sec. | 360 sec. | 271 sec. |
| Sound Forge 6.0 Resample | **234 sec.** | 287 sec. | 346 sec. | 259 sec. |
| Cleaner 5.0 Encode AVI to MPEG2 | 676 sec. | **659 sec.** | 819 sec. | 612 sec. |
| MusicMatch 7.1 Encoding | 170 sec. | **159 sec.** | 199 sec. | 148 sec. |
| MusicMatch 7.2 Encoding | 165 sec. | **155 sec.** | 191 sec. | 141 sec. |
| SETIbenchmark | **154 min.** | 159 min. | 186 min. | 149 min. |
| SISoft Sandra CPU ALU | **6239 MIPS** | 5027 MIPS | 4131 MIPS | 5936 MIPS |
| SiSoft Sandra CPU FPU/SSE2 | 3123 MFLOPS | **3458 MFLOPS** | 2804 MFLOPS | 3787 MFLOPS |
| SISoft Sandra RAM | 2526 MB/s | **3356 MB/s** | 3323 MB/s | 3332 MB/s |
| SISoft Sandra RAM | 2409 MB/s | **3349 MB/s** | 3315 MB/s | 3319 MB/s |
| SPEC ViewPerf 7.0 3DSMax | 7.8 fps | **10.59 fps** | 9.9 fps | 10.8 fps |
| SPEC ViewPerf 7.0 DVR-08 | 17.55 fps | **31.12 fps** | 29.04 fps | 31.13 fps |
| SPEC ViewPerf 7.0 DX-07 | 36.8 fps | **49.54 fps** | 43.88 fps | 52.11 fps |
| SPEC ViewPerf 7.0 Light-05 9. | 171 fps | **12.49 fps** | 10.82 fps | 13.19 fps |
| SPEC ViewPerf 7.0 Proe-01 | 6.799 fps | **11.73 fps** | 10.86 fps | 12.05 fps |
| SPEC ViewPerf 7.0 UGS-01 | 6.456 fps | **7.08 fps** | 6.44 fps | 7.35 fps |
| Commanche 4 1024x768 | 50.86 fps | **56.1 fps** | 46.71 fps | 59.8 fps |
| Quake III Arena Demo 1 640x480 | 276.8 fps | **353.5 fps** | 306.3 fps | 367.3 fps |
| Jedi Outcast 1280x1024 | 77.7 fps | **87.9 fps** | 75.5 fps | 93.4 fps |
| 3DMark2001 SE Patched | 14651 | **15174** | 13813 | 15442 |

Notes: Best scores in the 2800+ vs. 2.8GHz battle are printed red. *SYSmark2001* wouldn't run on our overclocked P4 for reasons unknown. All *SYSmark* numbers reflect a cumulative score generated by suite (higher scores are better). All application scores are reported in total seconds required to complete each test (lower scores are better). The *SPEC* and gaming tests are reported in frames per second (higher scores are better). *3DMark2001* reports a cumulative score; higher is better.


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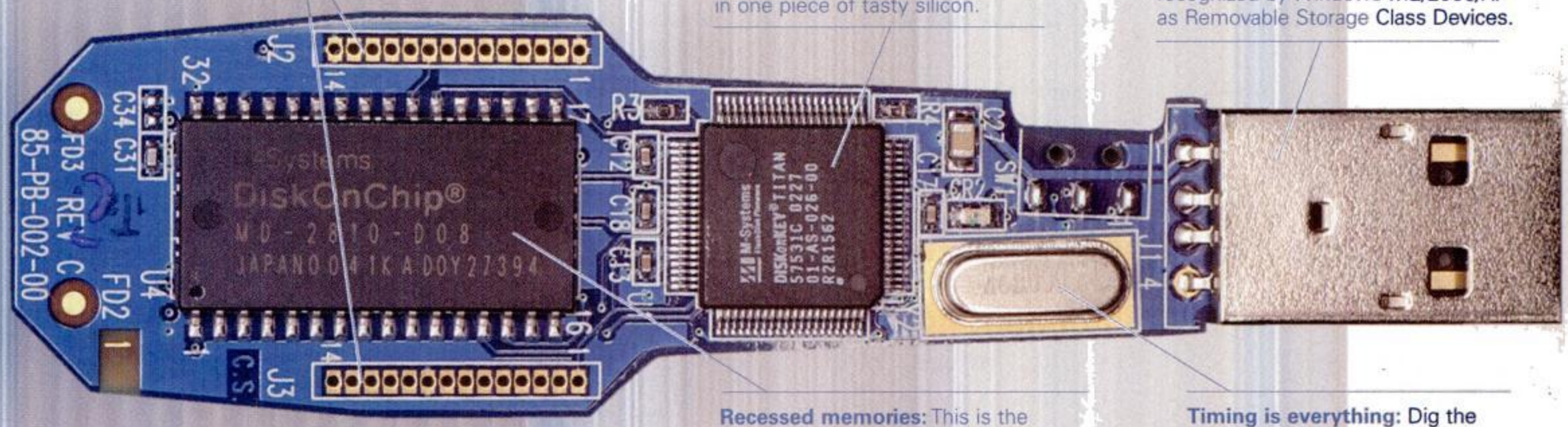
## Deep inside the DiskOnKey

**Make ours a double:** Because flash memory chips are currently manufactured with a maximum capacity of 128MB, these extension board connectors are designed to place two chips side by side for a 256MB configuration. What's more, another board can be added on top for 512MB of storage.

**Strong-arm tactics:** Although no flash memory resides on this chip, it's the real brains of a USB key. DiskOnKey's proprietary chip, code-named "Titan," combines an ARM-7 CPU, firmware, and USB controller in one piece of tasty silicon.

**Conjunction junction:** Here's the USB connector. USB keys don't require drivers because they have their own onboard controllers, and are thus recognized by Windows ME/2000/XP as Removable Storage Class Devices.




**Recessed memories:** This is the actual flash memory chip that contains all the memory cells for data storage. To find out how flash memory retains its contents without a constant source of power, see "How Flash Memory Works" on page 40.

**Timing is everything:** Dig the 12MHz crystal. Also used in motherboard chipsets, this timing mechanism orchestrates the efficient movement of data to and from memory cells.

# Pocket Rockets!

## Flash memory is now free to be USB

**Floppy drives may be the lowliest components in today's PCs, but they persevere because of a single redeeming factor: They allow us to transport small files from PC to PC easily and cheaply. Enter the USB key, which just might kill off floppies once and for all.**

**These portable widgets trump floppies at nearly every turn: They offer much more storage (up to 2GB!) and a file-transfer rate of around 1MB/sec. Plunging flash memory prices have brought the cost of USB keys down to manageable levels, and as long as you're using WinME or above, they don't require drivers to work. Best of all, they connect to USB ports, which have been standard in virtually every PC built in the last five years.**

**Here's an inside look at the latest crop of USB-based flash memory devices. Each and every one offers a compelling reason to finally leave the sloppy floppy behind.**

**—LOGAN DECKER**

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# Pocket Rockets!

**All USB keys are pictured at their actual size**

## KANGURU MICRO DRIVE

| | |
|---|---|
| Capacity tested | 128MB |
| Cost per megabyte | 66 cents |
| Maximum capacity available | 1GB |
| Write-protection? | Yes |
| Time to transfer 127MB | 5:32 |

Kanguru's Micro Drive comes with the most convenient accessory of the roundup: a matching docking station. Although it's really just a USB extension cord with a cradle at the end, it prevents you from having to crawl around the back of your PC if you don't have a front-mounted USB port. The transfer rate is well above average, and the price is definitely right, but Kanguru doesn't yet offer any fancy software, such as encryption or an e-mail client.

**VERDICT 8**

**$85** (for 128MB)

www.kanguru.com

## M-SYSTEMS DISKONKEY

| | |
|---|---|
| Capacity tested | 512MB |
| Cost per megabyte | 98 cents |
| Maximum capacity available | 512MB |
| Write-protection? | No |
| Time to transfer 127MB | 4:19 |

M-Systems sent the very first USB key to our Lab, and the company remains ahead of the pack with the fastest transfer rate we've ever recorded from a doodad of this sort (though it's neck and neck with Sony's Micro Vault). Available software is currently limited to *KeySafe*, which cordons off part of the key's storage in an encrypted, secure area. M-Systems is the only company to offer a firmware upgrade for increased compatibility with PC chipsets. Where's the 1GB, USB 2.0 version? Coming soon, says M-Systems.

**VERDICT 8**

**$500** (for 512MB)

www.diskonkey.com

## JMTEK USB DRIVE

| | |
|---|---|
| Capacity tested | 1GB |
| Cost per megabyte | 70 cents |
| Maximum capacity available | 2GB |
| Write-protection? | Yes |
| Time to transfer 127MB | 9:31 |

It's the big gig on a stick—an incredible amount of flash memory stuffed into a handsome, rubberized case. JMTek loads the key with a ton of software, including an e-mail client and a backup utility. Unfortunately, the USB Drive tanked in our transfer rate test, logging a tragic 9:31 to transfer 127MB of files. This hardly bodes well if you need to fill the entire 1GB capacity. The USB Drive is an expensive alternative to a floppy disk drive, but then again, a floppy can't hold a year's worth of e-mail and attachments.

**VERDICT 7**

**$700** (for 1GB)

www.usbdrive.com

## TREKSTOR USA THUMBDRIVE

| | |
|---|---|
| Capacity tested | 16MB |
| Cost per megabyte | $1.88 |
| Maximum capacity available | 128GB |
| Write-protection? | Yes |
| Time to transfer 16MB | 2:10 |

If small is your thing, the ThumbDrive Smart is your key—it's the smallest driverless USB key we've ever seen. It doesn't come with any software, nor is any available, and at two minutes and 10 seconds to transfer just 16MB of files, it's agonizingly slow. But it will nest nicely in the smaller pocket of your jeans.

**VERDICT 7**

**$30** (16MB)

www.thumbdrive.com

*32MB version reviewed in September 2001*



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# SONY MICRO VAULT

| | |
|---|---|
| Capacity tested | 128MB |
| Cost per megabyte | $1.17 |
| Maximum capacity available | 128MB |
| Write-protection? | No |
| Time to transfer 127MB | 4:19 |

Sony knows how to make sexy stuff. And the Micro Vault—with its tinted, translucent window and slim outline—is definitely the looker of the pack. But it's not particularly sturdy (the case came apart after a few months of use), doesn't come with any software, and it's also one of the most expensive keys in the roundup. The transfer rate is identical to M-Systems' DiskOnKey…hmm…we wonder whose chip is inside.

VERDICT 7

**$150** (128MB)

www.sonystyle.com

# SANDISK CRUZER

| | |
|---|---|
| Capacity tested (MMC card) | 64MB |
| Cost per megabyte | $1.25 |
| Maximum capacity available | 256MB |
| Write-protection? | No |
| Time to transfer 64MB | 2:49 |

SanDisk came around with another first for us—an upgradeable USB key. Pop an MMC card into one side of the Zippo-size case, slide the button on the top, and the Cruzer sucks in the card and pops a USB connector out the other side. The Cruzer comes with an MMC card included (in capacities ranging from 32MB to 256MB), but you may already have one in your MP3 player or Pocket PC. We wish it was a little smaller, though, or that SanDisk had at least built a real lighter into the case.

VERDICT 8

**$80** (64MB)

www.sandisk.com

# CREATIVE LABS MUVO

MAXIMUM PC KICK ASS PRODUCT

| | |
|---|---|
| Capacity tested | 128MB |
| Cost per megabyte | $1.02 |
| Maximum capacity available | 128MB |
| Write-protection? | No |
| Time to transfer 128MB | 36:53 |

Not only does Creative Labs' MuVo accept up to 128MB of files, but it also includes a hardware decoder that will automatically play any MP3 or WMA files you load (in the root directory only). *No software required whatsoever.* Playback requires the included battery pack. It's more expensive than the other keys, but considering that it does double-duty (and sounds great), we think it's more than worth it. As a data transfer device, it's unfortunately the slowest of the pack—by far.

VERDICT 9

**$130** (128MB)

www.muvo.com

# LEXAR MEDIA JUMPDRIVE

| | |
|---|---|
| Capacity tested | 64MB |
| Cost per megabyte | $1.25 |
| Maximum capacity available | 128MB |
| Write-protection? | No |
| Time to transfer 64MB | 2:34 |

"Ooh" and "aah" is what they'll say when you whip out the JumpDrive—the translucent trim shows all the works inside. Other than that, though, the JumpDrive is a fairly middling performer, with a somewhat high cost per megabyte and no software available for download. Still, it's small and comfortable to insert and remove thanks to the broad, flat surface.

VERDICT 7

**$80** (64MB)

www.digitalfilm.com

*Originally reviewed April 2002*

*Originally reviewed October 2002*



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# How Flash Memory Works

Everything you always wanted to know about Fowler-Nordheim tunneling

Flash memory comes in diverse forms: SmartMedia cards for your MP3 player, MMC cards for your PDA, and even memory cards for game consoles. The mysterious capability they all share is the ability to retain their contents even when power is shut off. To understand how "non-volatile" memory works, you first need to know how the standard "volatile" main system memory in your PC operates.

The memory cells in a standard RAM chip are laid out like the cells of a spreadsheet—in rows called wordlines, and columns called bitlines. The intersections of the wordlines and bitlines constitute the address for each cell. When RAM is being written to, voltage is applied individually to these cells via the bitlines. Whether each cell is charged or uncharged determines if the cell's binary value is 1 or 0.

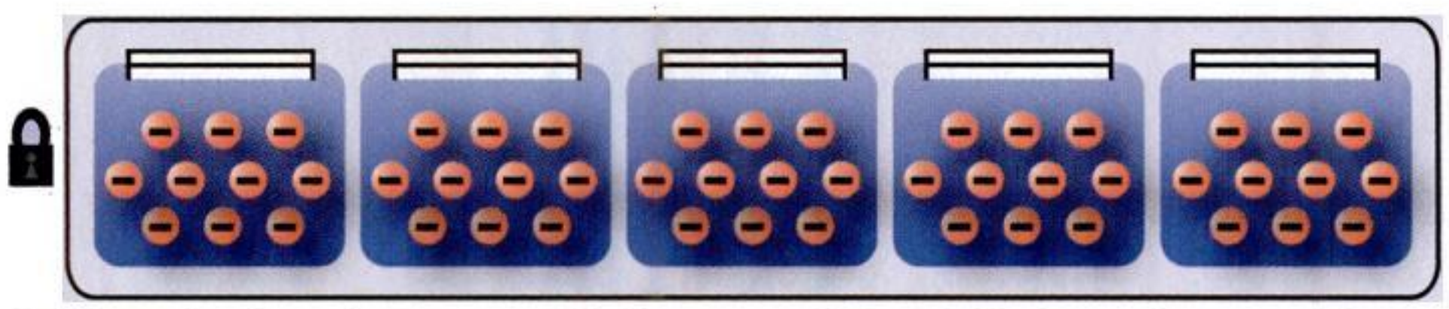
But here's the rub: As soon as these volatile cells are charged, they begin to lose their voltage, so the charge must be constantly refreshed. That's where we get the refresh rating on RAM: Each cell in 70ns RAM is recharged every 70 nanoseconds. When you turn off your PC, the contents of the RAM chips are immediately purged, because without power, the cells can't be recharged. All is lost.

Although flash memory uses a similar configuration—memory cells are still arranged in a grid—the way information is stored (and thus retained) is different.

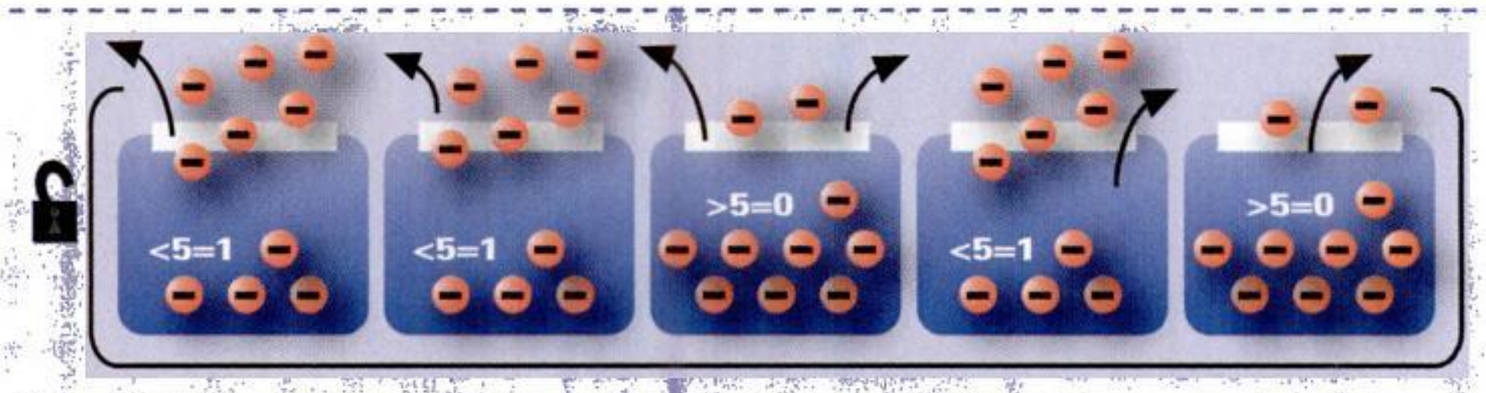
Each cell in a nonvolatile flash memory chip is similar to a prison cell with an electronic gate. A bunch of electrons—let's say 10, for example—are huddled inside the cell. By applying a charge to the gate, the gate swings open and all the electrons rush out, just like real convicts would. The gate automatically swings shut when a certain number of electrons have passed through.

When nonvolatile memory is read, each electron in each cell is counted. If the cell contains five or fewer electrons, the cell represents a binary value of "1." If the cell contains six or more electrons, it represents a "0." These values remain the same even without a consistent source of power, because only the opening and closing of the gates (which does require power) affects the number of electrons in the pokey. Of course, it's all a little more complicated than this, but that's to be expected from a process that uses the principles of quantum mechanics. In fact, the process of pushing electrons to and fro in flash memory is called "Fowler-Nordheim tunneling," an homage to the guys who came up with the equations describing it.

## THE FLASH MEMORY ELECTRON FARM



**The illustration above shows a row of flash memory cells in their blank, unwritten state. The electronic gates are closed and can only be opened when power is applied to the chip.**



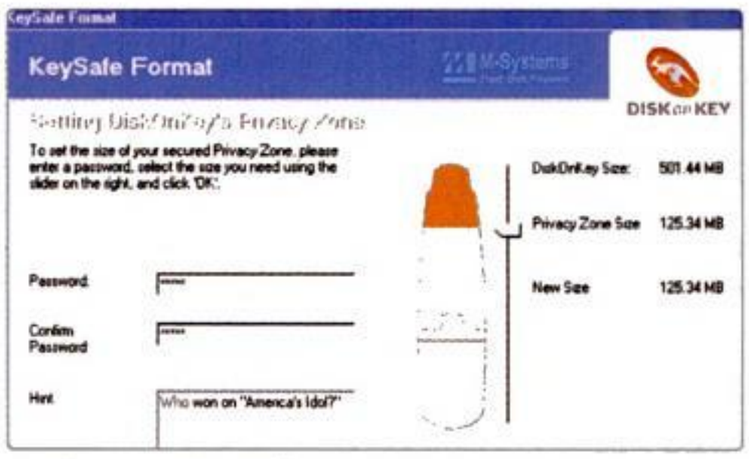

**Once power is applied to the gates, they swing open and selectively release a number of electrons. Once the voltage is cut off, the gates snap shut, trapping the electrons in a fixed state. In the example above, each cell that contains five or fewer electrons is read as a binary "1," while each cell that contains six or more electrons is read as a binary "0." These 1s and 0s form the digital information stored in the flash memory chip.**

# Software on a Stick

The best of the USB key applications

### M-SYSTEMS KEYSAFE

**This one turns any portion of your M-Systems key's memory into a password-protected, encrypted "privacy zone." Just drag the slider as seen in the screenshot to adjust the amount of memory you want assigned to the zone. The 660KB app resides on the key itself, so it doesn't need to be installed on each PC that you use your key with. Every time you insert the DiskOnKey, *KeySafe* prompts you for a password. If you've got it, the privacy zone immediately opens up in an Explorer window. If you don't, the non-secure area is opened instead. All the files in the privacy zone are completely invisible. In fact, if you check the storage capacity reported by Properties, it reports only the space in the nonprotected area. An identical application, renamed *Security Zone*, is available with Sony's Micro Vault.**


KeySafe Format
KeySafe Format
M-Systems
DISKonKEY
To set the size of your secured Privacy Zone, please enter a password, select the size you need using the slider on the right, and click 'OK'.
DiskOnKey Size: 501.44 MB
Privacy Zone Size 125.34 MB
New Size 125.34 MB
Password
Confirm Password
Hint
Who won on "America's Idol?"

**M-Systems KeySafe**

### JMTEK'S USB-LOCK

**Here's another one for the paranoid. Once you launch *USB-Lock* from the USB Drive, removing the USB Drive from the USB port immediately locks down your PC. A giant logo (pictured in the screenshot) leaves no question about how you feel about snooping, and not even a reboot can get around it. ■**

**JMTek's USB-Lock**



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# MOBO minutia

## INSIDE & OUT

**An exhaustive guide to mobo engineering, manufacturing, and formfactors. Every detailed revealed!**

Thanks to the explosion of web sites offering hard-core motherboard information, seemingly every PC enthusiast is calling himself a "mobo expert." But how much do you *really* know about motherboards, beyond the details of their various specs and features? Do you know what motherboards are made of? Do you know *how* they're made? Well you should, because that board inside your computer, however typical it may seem, goes through a very non-typical journey before it sees the light of day—and the more you know about this journey, the better prepared you'll be for your next overclocking, troubleshooting, or upgrading project.

In the next seven pages, we'll explain exactly how a motherboard is created—from the original conception process, to design and manufacturing, and all the way to testing and validation. We'll also familiarize you with the five classes of motherboard formfactors that you're likely to encounter today. That's right, people: All the information you've ever wanted about motherboards but couldn't find anywhere else.

Welcome to the complete guide to mobo engineering.

### Too Much Coffee, Too Few Baths

The design process starts with a team of engineers: They're tossed into a dungeon along with a small supply of instant noodle cups, and instructed to get cracking. While they brainstorm over what features they want in their next motherboard, another team is busy tracking down suppliers for proper production materials. These materials generally fall into two classes: active components (like voltage regulators, transistors, and device controllers) and passive components (like resistors, capacitors, and diodes). Active components perform complex operations, such as refreshing onboard memory and controlling and switching current—they have an *active* effect on the board's data and electricity. Passive components can't control current and don't perform any switching functions. They store electrical charges and change the form of electrical signals, but they don't provide any electrical amplification or gain.

After weeks of eating junk food, drinking burnt coffee, and ignoring their personal hygiene, the engineers emerge from the dungeon with a motherboard design they'd like to see manufactured. At this point, the engineers begin drawing electrical schematics. Using complex formulas and algorithms, they work to ensure that all the components placed on the board will work in harmony. A substantial part of the process involves studying component specs and knowing the exact function of each pin on every chip. For example, if the pin on one device is incorrectly routed, a certain function may not work, or the chip may do something unexpected. Luckily for PC enthusiasts, the process is somewhat protected from human error: To root out any potential bugs, the engineers use logic-verification software to analyze a board's circuits.

The next step involves creating an actual board design based on all the groundwork laid during the earlier phases of the engineering process. This demands arranging components and traces (microscopic wires) in the most efficient manner possible. Each aspect of the board is scrutinized to ensure that it's designed within specification.

For example, if an electrical trace is too long or narrow, the signals passing through it will be weakened. Traces and components must also follow strict distance

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BY TUAN A. NGUYEN



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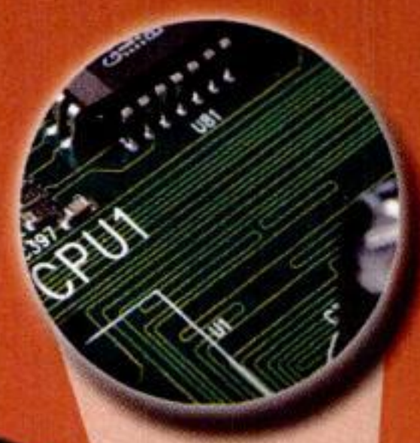
# A TOUR OF MOBO TOPOGRAPHY

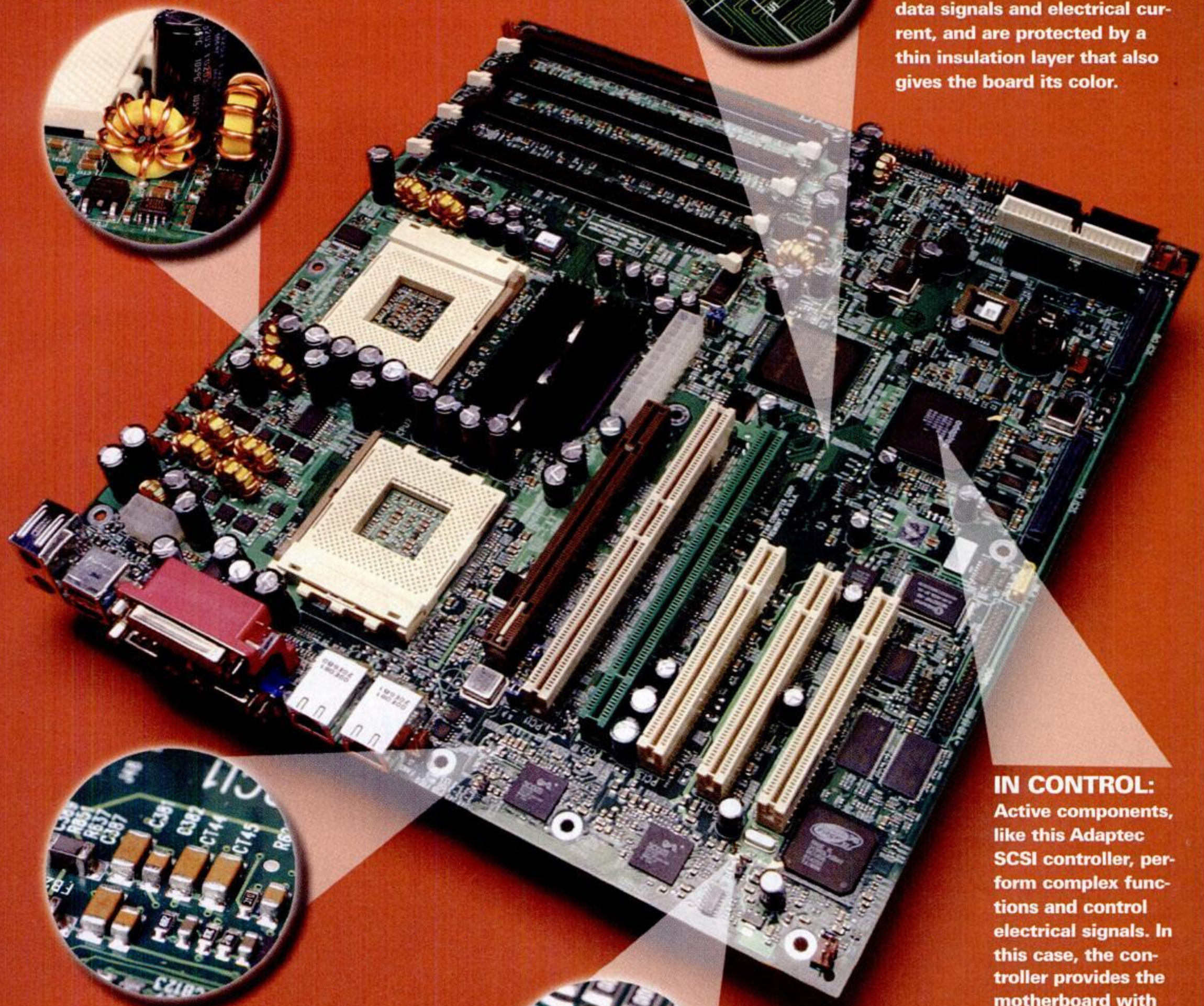
## Just what does one find atop a Tyan Thunder K7X?

**MAINTAINING THE PEACE:** The components pictured here form what's known as a VRM, or voltage regulator module. Made up of capacitors (the tall tubular structures), inductors (the yellow donut-shaped components), and transistors (the flat, black squares), the VRM is critical for keeping CPUs electrically stable. Lest there be any confusion, a capacitor smoothes an AC sine wave into a DC line current; an inductor changes a current's direction; and a transistor regulates a current, essentially performing the role of a gate or switch.



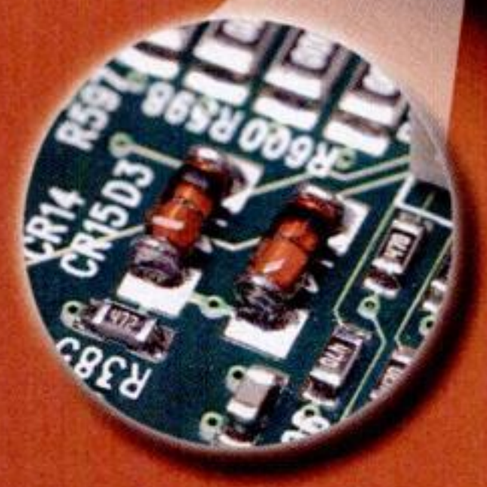



**SMALL, THIN, COPPER:** Incredibly fine copper traces traverse the motherboard, both inside and out. The traces carry data signals and electrical current, and are protected by a thin insulation layer that also gives the board its color.





**RESISTANCE IS NOT FUTILE:** The small, brown, surface-mounted resistors that pepper the board are passive components. They can't control electricity in any manner; they can only resist current.




**ONE-WAY ONLY:** A diode is a passive solid-state device that allows electricity to flow in only one direction. Some common examples of diodes are LEDs (light emitting diodes) and photodiodes. Remember old vacuum tubes? They're essentially diodes as well.

**IN CONTROL:** Active components, like this Adaptec SCSI controller, perform complex functions and control electrical signals. In this case, the controller provides the motherboard with SCSI support.



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CONTINUED FROM PAGE 42

specifications. Some traces that carry high power, for example, must be at least 0.5 inches away from any other traces, or else they may cause interference. And then there are heat issues. Sometimes traces run so hot, they must be spliced into multiple traces, then subsequently grouped back together. The spliced traces effectively become heat dissipaters, channeling small amounts of electricity through individual strands instead of a large amount through a single strand.

The motherboard's actual circuitry and component layout—every trace, contact, and device controller—is designed using CAD software. This is actually one of the most brutal tasks that occurs during a motherboard's entire development phase. Because of the massive number of components and electrical traces that a motherboard carries, it's impossible to place everything on one surface; there's just not enough room to connect everything. To solve this problem, engineers design motherboards in multiple layers, with each layer containing its own traces.

Eventually, each trace layer is sandwiched together to form a multilayer PCB (printed circuit board). Perhaps you've heard motherboards referred to as "four-layer" or "six-layer." This directly relates to the number of physical layers a board includes.

At the culmination of the CAD design process, a virtual circuit layout emerges. The engineers then test this model with logic simulators—programs that run calculations on all the proposed circuits and verify that the board is good to go. After the engineers are certain their design works, the design is approved, and components are ordered so that production can commence. The layout of the board is then sent to the manufacturing facility.

## Now You Know Why They Wear Protective Clothing

At the factory, the first step is to create some sample motherboards based on the engineers' layout. This process starts with the production of the hard boards that will eventually play host to hundreds of traces and components. These boards are composed of fiberglass, plastics, dielectric and insulating chemicals, synthetic chemicals, and organic chemicals (such as those found in cow dung). All these materials are combined to form a hard fiber layer, then a layer of copper is applied on top. Special plastics are then applied atop the copper.

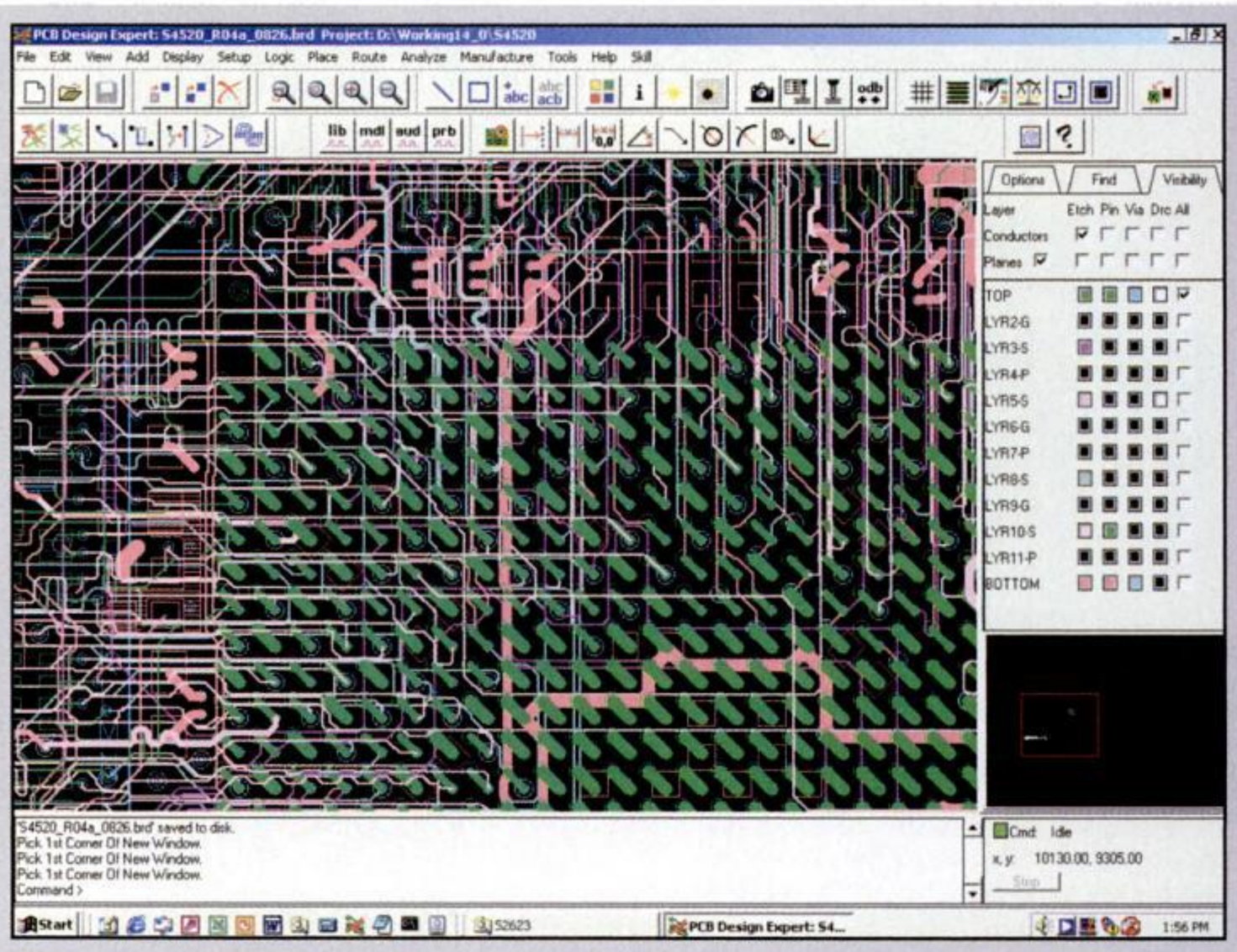
Once the board material is ready to roll, the engineers' circuit designs are transferred to high-contrast, high-resolution film. Each piece of litho-film is essentially a picture of a single layer of the motherboard's layout. When placed over the board, the litho-film serves as a light mask: The black areas of the film prevent light from passing through, while the clear areas allow light to pass through—and every area through which light passes will end up being home to an actual trace or component. This is why high-contrast film is so important: If any circuitry detail fails to be resolved, the motherboard simply won't work.

After a mask is placed over the board, ultraviolet (UV) light is directed over the mask. The UV light passes through the clear areas of the mask and strikes the PCB's plastic coating, hardening the exposed plastic. The PCB is then cleaned in a chemical solution that washes away the *unexposed* plastic. This leaves bare copper in all the areas that were originally covered by the unexposed plastic. The PCB is then submerged in a solution of Sodium Persulphate which washes away the bare copper, leaving behind an array of copper traces still protected by hard plastic. The PCB next gets another bath, and the remaining plastic film is removed, leaving behind exposed copper traces. And thus a PCB layer is created!

Each layer has its own unique traces, all of which connect to the traces of neighboring layers through metal-coated holes called "vias." Each layer is manufactured in a similar fashion, and all the layers are sandwiched together with insulation layers in between. Once the board becomes a single unit, its surface is coated with a protective solder mask. The solder mask is a chemical insulation layer that protects the PCB from soldering paste—solder actually drips right off the mask. High-quality motherboard solder is a special blend of lead

## Why Green?

**One of the most common questions about PCBs is, Why green? The simple answer is that a board receives its color from the solder-mask that's used to protect it from soldering paste and the copper traces from oxidation (rusting). Any color can be used, and color has no effect on a board's electrical attributes. Most boards are green because someone simply started using green, and the color became standard. Nonetheless, black and red PCBs are emerging as noteworthy alternatives.**




**The program *PCB Design Expert* is ready to design multilayered boards, and can define the placement for every component that will eventually be soldered on. In this screenshot, the different layers of a board are represented by different colors.**



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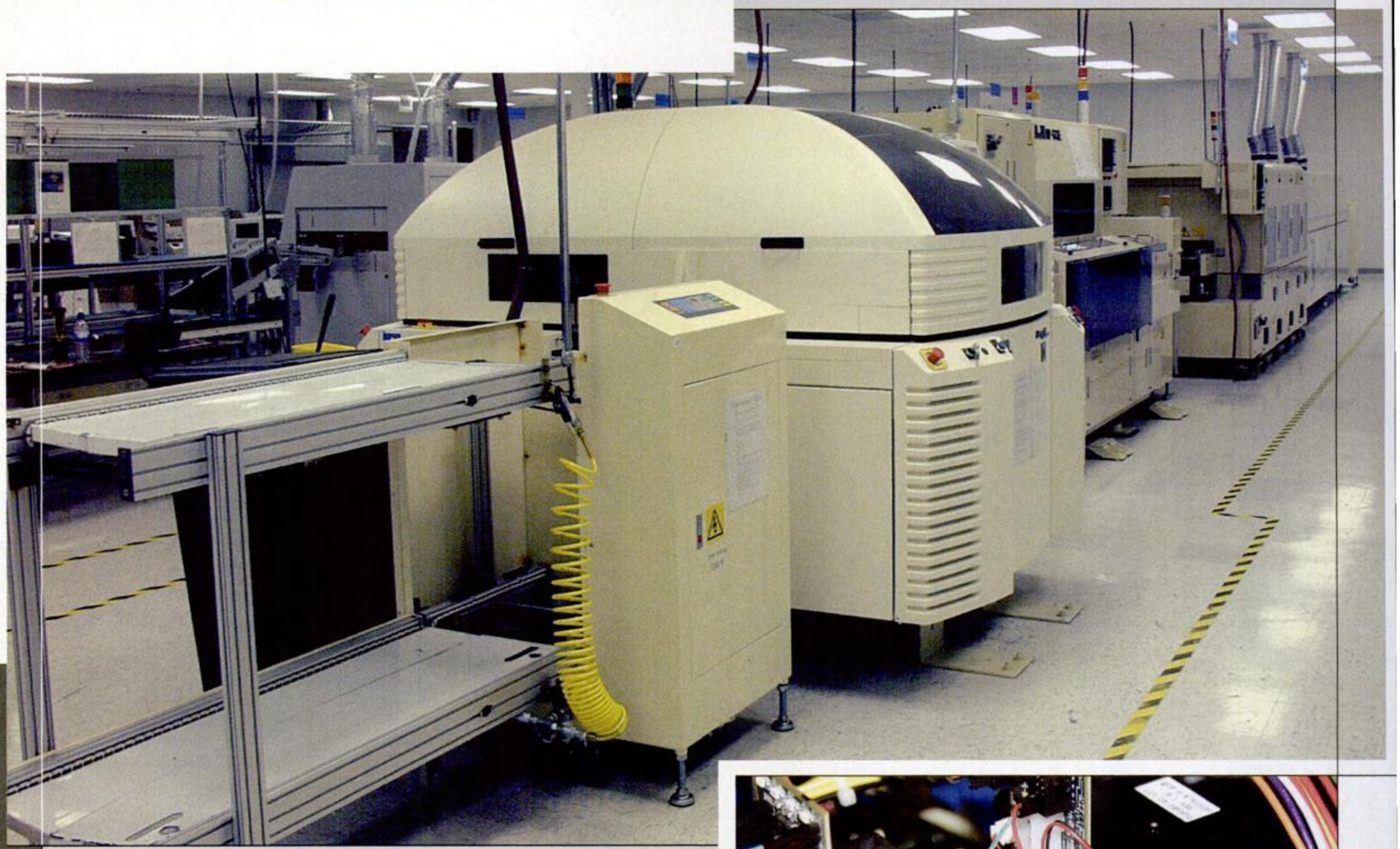
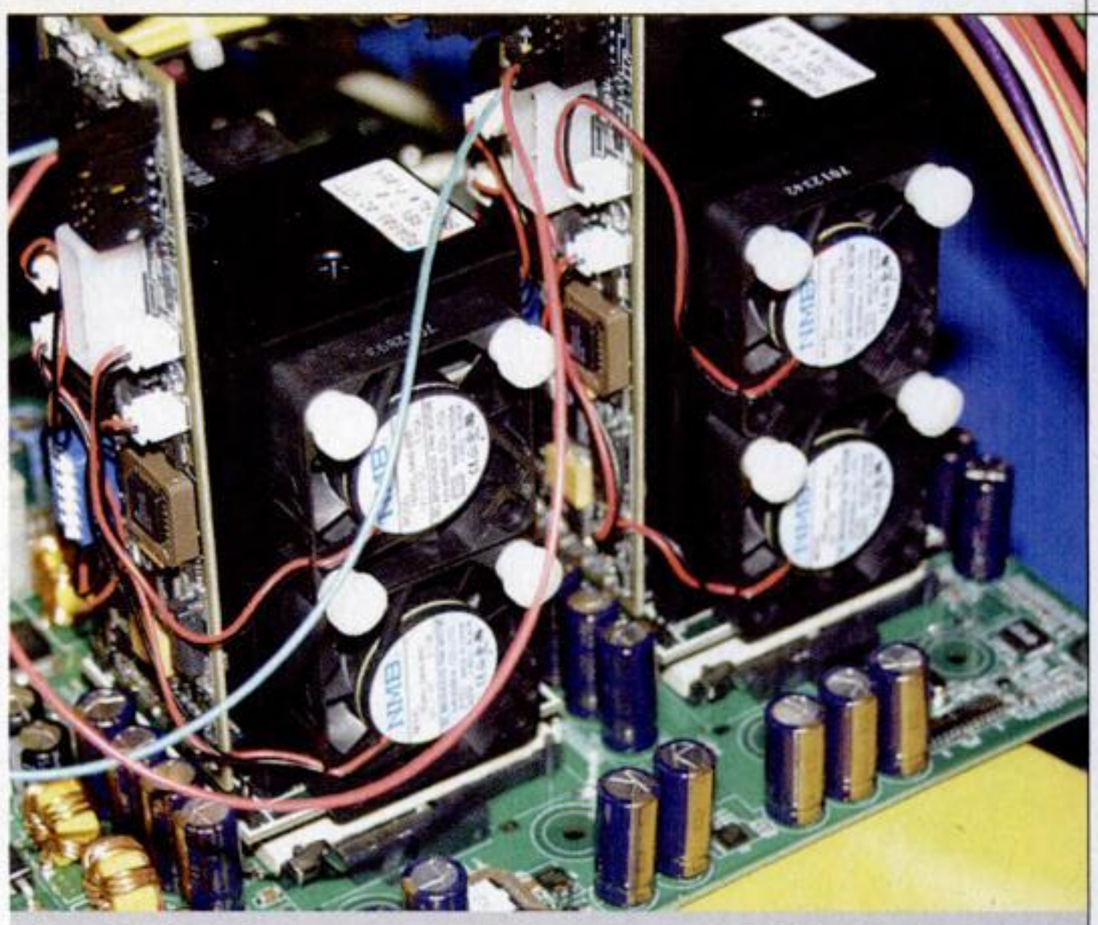
# MOBOS



**Here we see a Surface Mount Technology (SMT) assembly line. An empty PCB is placed at the front of the line, then emerges as a complete motherboard. The SMT machines can be configured to build different types of boards; the large-scale assembly lines can produce more than 1,500 boards a day.**



**Emulating the power requirements of CPUs, VTT (voltage transient test) tools are inserted into a mobo's CPU sockets. They diagnose the board's VRM (voltage regulator module), testing whether enough current is being supplied to the socket at the proper voltage.**

and tin (63 parts lead, 27 parts tin) that melts easily and conducts electricity very well. Please note: This isn't the type of solder used for clock radios or to weld pipes together. Nope, the solder used for computer equipment has a mirror finish and flows smooth as cooking oil.

Motherboard solder is usually applied by a machine that beats a bath of liquid solder across the mobo like a wave. The motherboard is guided over the surface of the wave, and as the waves break against the board, the solder sticks to areas that aren't covered by the solder mask. These solder-covered areas serve as the connection and attachment points for components.

Once the solder is ready, the motherboard is fed into a hefty machine called a "Pick and Place" that will position all the necessary components onto the board. The components are loaded into reels (similar to film reels), and the reels are loaded into the machine. As the board goes through the machine, the components are placed in their proper positions, and heat is applied to melt the solder. The solder turns into a shiny solid, locking the components onto the board. After one side of the board is populated with components, the process is repeated for the other side, until the entire board is complete with chipsets, circuits, sockets, and connectors.

When a full prototype emerges from the oven, it's sent back to the engineers for testing. This is a critical step, because actual hardware is much more unforgiving of failures than virtual boards that merely exist in software. (After all, the logic simulators used for testing might possibly contain bugs themselves!) The engineers basically beat the hell out of the prototype. They zap it with electromagnetic interference emissions, subject it to heat and cold, and run it through a barrage of electrical and software tests. If the board endures its torture testing, it's reproduced by the thousands (and sometimes millions), then shipped to system vendors and eager hardware hackers.

One such motherboard is sitting inside your computer right now.



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# MOBOS

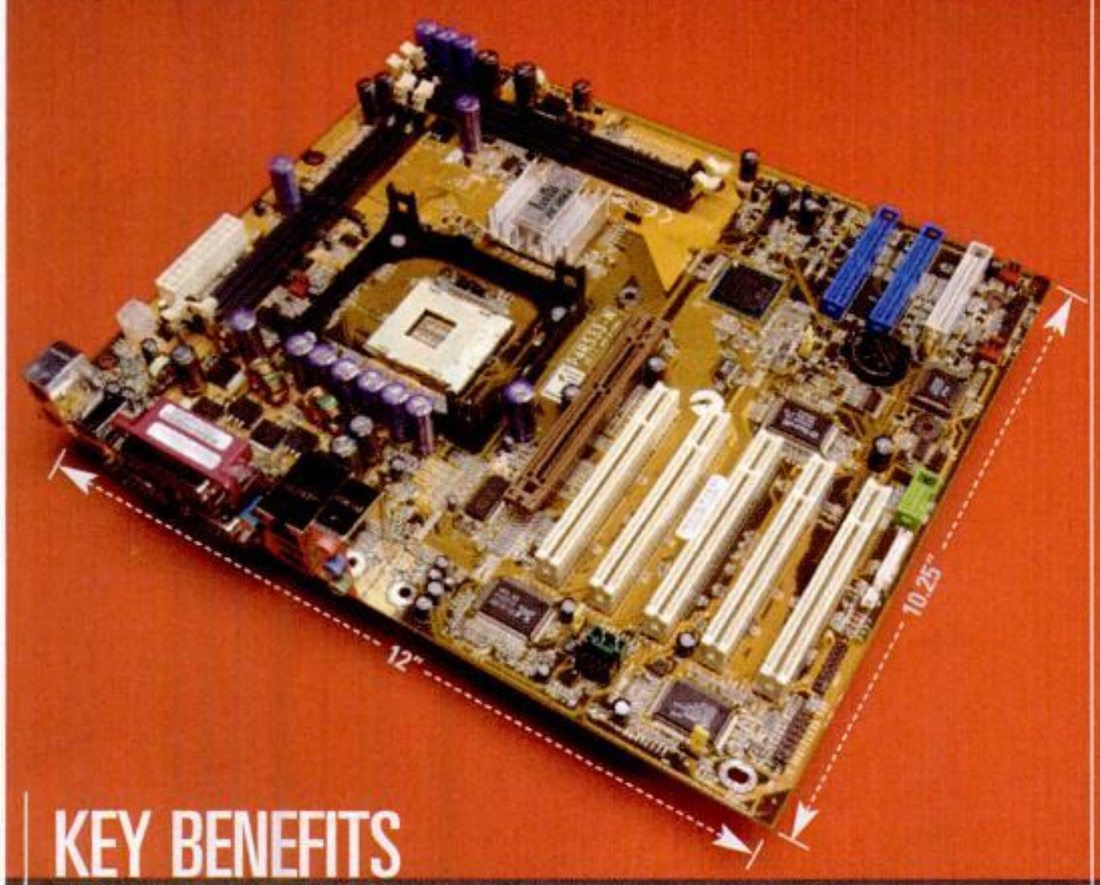
# Meet the FORMFACTORS:

**Every motherboard is designed according to a particular "formfactor"—an industry standard that describes a board's size and shape, and determines what can and cannot be placed on top of the board. Here's a look at the five formfactors you're most likely to encounter today...**

## ATX

Most current consumer motherboards are based on the ATX formfactor, which in turn evolved from the Baby AT formfactor. ATX revolutionized motherboard design by calling for more sensible component placement. For example, previous motherboard designs had CPU sockets sitting annoyingly close to PCI slots. This presented problems when CPUs began requiring heatsinks—the cooling devices prevented the installation of full-length add-in cards. As you can see from the photo here, ATX moved the CPU away from the slots for a more harmonious coexistence. The ATX formfactor also beckoned stacked I/O ports, which keep all external peripheral connectors in a nice, tidy area.

Even though ATX is a formfactor standard, not all components that are placed onto an ATX board will follow the ATX spec exactly. For example, power and IDE connectors are bound to move around from board to board. ATX has been with us since the days of the classic Pentium processor and has served enthusiasts well. That said, the formfactor is showing signs of age now that the rest of the PC hardware world is maturing. For example, future videocards will require larger and larger heatsinks to dissipate heat, and they won't fit into an ATX mobo if the AGP slot is too close to an adjacent PCI card. The next generation of formfactors should resolve such issues.



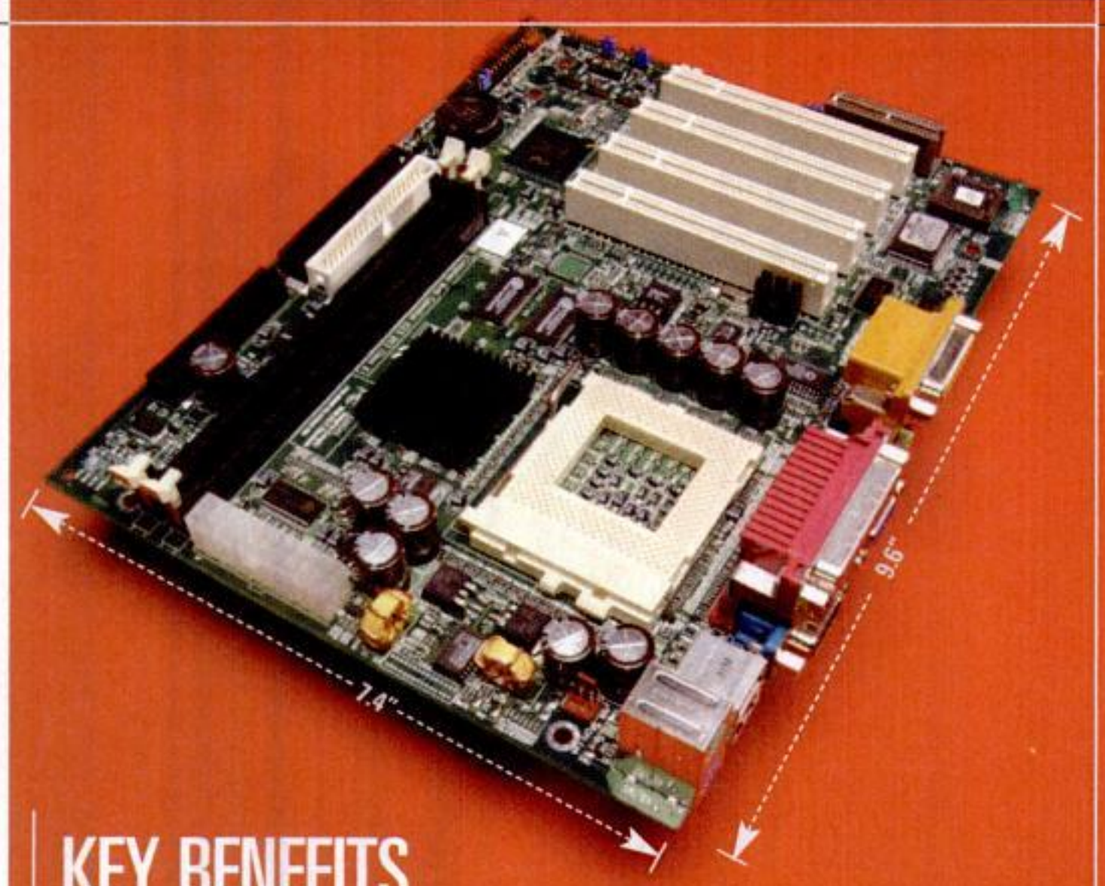

### KEY BENEFITS

- All expansion slots accept full-length cards
- Processor, memory, and expansion slot locations all facilitate easy upgrades
- Relocated processor allows easier use of voltage-regulating circuitry

## MicroATX

MicroATX is derivative of the ATX formfactor, following the same layout design. A MicroATX motherboard is roughly three-quarters the size of an ATX motherboard and is intended for use in small enclosures—for example, the small computers used in hospitals or net cafés. Because of their small dimensions, MicroATX boards usually have integrated audio and video (that is, audio and video functions are either directly integrated into the board's core-logic chipset or available via discrete controller chips soldered onto the motherboard). More recent MicroATX boards also come with integrated Ethernet support. If you're in the market for a MicroATX board, make sure it has at least two available PCI slots and an AGP slot, just in case you find that the onboard video is insufficient for 3D gaming (pretty much all integrated video is lame).

Because they often come with just two or three PCI slots, MicroATX boards aren't for everyone. But if you're in the market to build a low-cost, small formfactor, high-performance gaming machine, look no further than a MicroATX board.




### KEY BENEFITS

- Small formfactor (though still installable in an ATX chassis)
- Integrated features reduce the need for expansion cards
- Low manufacturing cost for boards
- Supports small enclosures and power supplies



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# FlexATX

The FlexATX spec is an interesting one because it doesn't offer anything over MicroATX save for an even smaller size. It's roughly three-fourths the size of MicroATX and also provides many integrated features. You'll most likely find FlexATX in very slim computers—for example, a machine that houses all its guts directly behind an LCD screen. This approach saves a considerable amount of space. FlexATX boards will have just two PCI slots if video is integrated. Count on just a single PCI slot if an AGP slot is provided.

Most FlexATX boards are purchased by large OEMs such as Sony, Compaq, and IBM, which build small workstations and terminals for their own special customers. However, if you're game, FlexATX motherboards can be installed in both MicroATX and regular ATX enclosures.

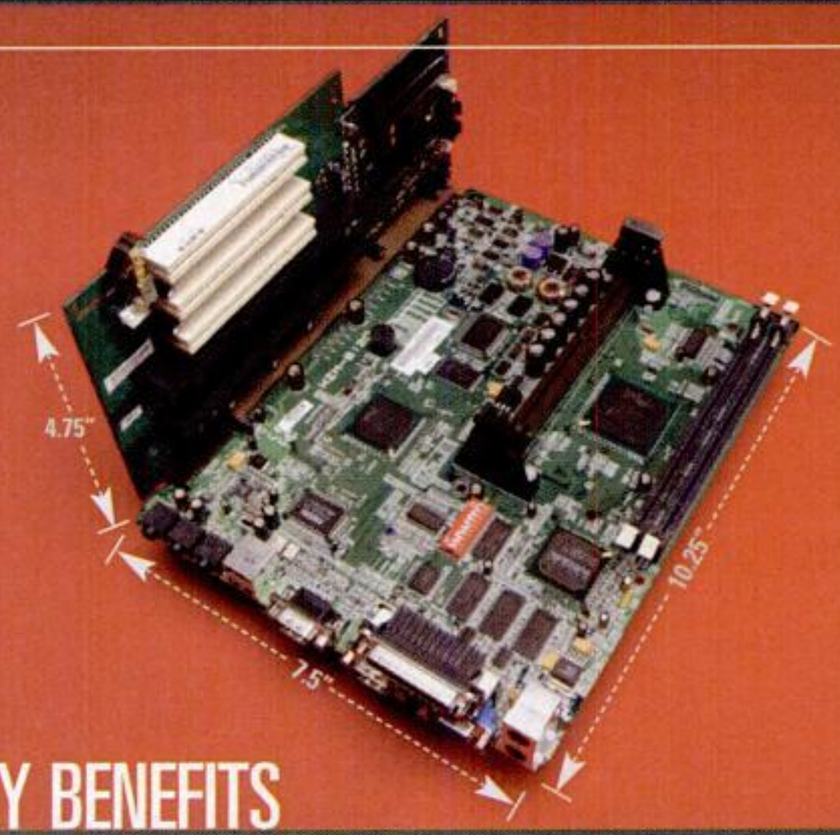
## KEY BENEFITS

- Even smaller than MicroATX!

# NLX

Both FlexATX and MicroATX originate from the ATX formfactor, but NLX is in a class of its own. It doesn't look anything like ATX, and its two-piece design can be quite startling to people the first time they see it. The NLX main board hosts the CPU socket, core-logic chipset, I/O ports, memory slots, and AGP slot (if an AGP slot is offered). A second riser board (also know as a "daughtercard") fits into the main board at a 90 degree angle and hosts expansion slots and IDE connectors. PCI cards lie parallel to the main board, which optimizes space significantly and allows manufacturers to design special enclosures of odd dimensions.

NLX boards are designed to be easily removed from their enclosures; they just slide right out on drive rails from the side of the chassis. The daughtercard, meanwhile, stays attached to the chassis structure. In theory, the easy access improves emergency response times for IT workers. NLX boards are typically designed with custom features for the "pizza boxes" sold by large OEMs, so you'll rarely (if ever) see them marketed to hardcore system tweakers.




## KEY BENEFITS

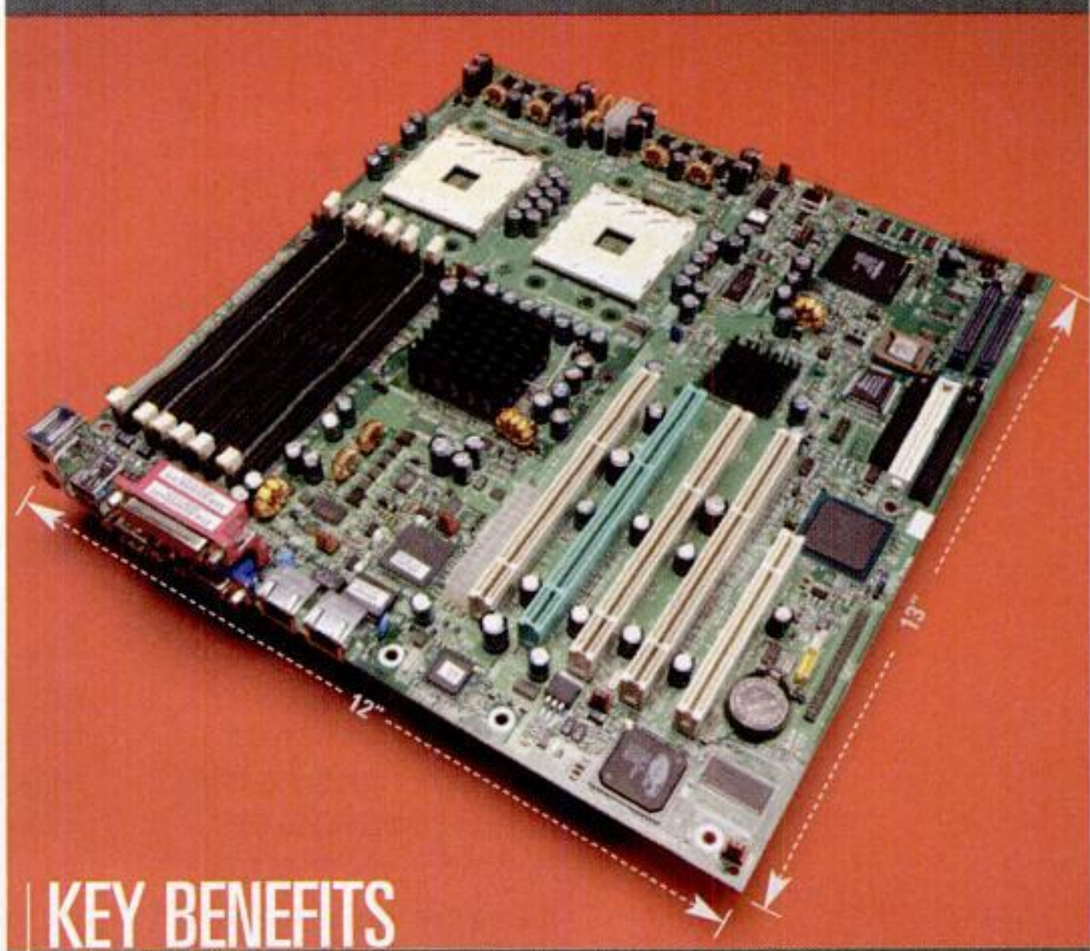
- Small physical footprint
- Riser card greatly reduces enclosure size
- Easy board removal

# CustomATX

The Custom ATX formfactor has a few variations, the two most popular of which are the SSI EEB and E-ATX standards. SSI EEB (Server System Infrastructure Entry-level Electronics Bay) caters to entry-level, dual-proc server boards that need to accommodate large heatsinks. Previous boards would bend and warp out of shape with heavy cooling mechanisms installed. SSI EEB relieves the stress by offering four enclosure mounting studs for each CPU socket.

The E-ATX (Extended ATX) spec was designed by AMD to support its dual-processor platform. From experience, we can say that E-ATX needs improved component location and power-supply support. Initially, E-ATX motherboards only accepted very hard-to-find and proprietary power supplies.

SSI EEB and E-ATX are based on an ATX spec, but they're both bigger and roughly square, whereas ATX boards are rectangular. SSI EEB and E-ATX boards have similar shapes and mounting holes, but differ in their location of socket support studs. If you plan to buy a board based on either formfactor, make sure that the enclosure you use supports the appropriate mounting holes, and that your power supply supports the board you're using. Boards based on these two specs usually contain high-end SCSI and server management features, and are expensive to produce. ■




## KEY BENEFITS

- Rip-roaring and ready to go for two-way servers

# Ask the Doctor

**Symptom → Diagnosis → Cure**

Have a burning PC problem? How about a burning PC sensation? We're more than happy to help you with your PC problems, but you might want to get that sensation thing checked out by a qualified sensation checker-outer. If you have PC questions, send them to **doctor@maximumpc.com**. Just remember: We can't answer every e-mail. Oh, no—not by a long shot.

## Oh My God! You Killed a GeForce!

I recently purchased a Gigabyte GA-VR7XP rev. 2.0 motherboard. I have 512MB of PC2100 DDR SDRAM, an AMD Athlon XP 2100+, and an nVidia GeForce4 Ti 4600, all running on Windows 2000 Professional. It was working fine until I swapped the videocard with one in my old computer. On reinsertion, nothing would boot, I couldn't even get it to POST. I then put my old card back in and still nothing. Oh where, oh where has my video gone?

***Many low-grade power supply vendors have no problem slapping 300-watt stickers on power supplies that aren't actually rated for more than 200 watts.***

I'm also having trouble booting into ATA133 via the jumper or BIOS. Every time I switch this in the BIOS it reverts to the slower mode. And, yes, I have an ATA133 hard drive.

**— ANDREW ARMSTRONG**

**First, you should get your old PC working to verify that you haven't killed your videocards. It's highly unlikely that both cards died, however. It's more likely that you jostled something loose during your tinkering. Put the videocard back in and make sure it is firmly seated. Also reseat memory, power, and other components to make sure you didn't knock them lose. If the mobo has an onboard speaker, make sure it's enabled. If the speaker is external, make sure you have it plugged in so you can hear if you're getting a POST beep code error.**

**Also keep in mind that the KT333 motherboard needs the correct memory to run the CPU at full speed. If you're not running DDR333 (aka PC2700) you'll need to clock the bus speed down from 333MHz to 266MHz. The board should read the capacity off the modules and set the speeds correctly, but if the modules are misprogrammed or the board is misreading the memory, that could cause the timing to be set incorrectly and keep your machine from booting properly.**

**One thing you didn't mention is your power supply. Many Athlon-related booting problems stem from low-quality power supplies. Even if the power supply says "AMD-approved" or bears a 300-watt rating, it may mean nothing. Many low-grade power supply vendors have no problem slapping 300-watt stickers on power supplies that aren't actually rated for more than 200 watts.**

**If you're having problems running your drives at ATA133, it may be the cable. An ATA cable that's longer than 18 inches, for instance, may cause the drive to perform erratically. Make sure you're running high-quality, 80-conductor cable that is no longer than 18 inches.**

## My RAM Isn't Showing Up in Win98

I was happy when I installed my 512MB DIMM in my new PC (800MHz Pentium III Slot 1), but when it boots it will read the 512MB RAM as up to 524MB RAM, but when I check the Windows 98 control panel, it shows just 256MB of RAM. I thought it may have been the video. Since I have an open AGP slot, I installed a 32MB nVidia GeForce card, but now and then, it struggles playing *Quake III Arena*.

I'm also having a problem with the audio getting stuck when playing games or when listening to music while in *Photoshop*. Can I replace my onboard sound with a soundcard, and will it help? Finally, is there any way to get more speed out of my CPU?

**— RICHARD WILSON**

**Some HMOs would charge multiple co-payments for that many questions, Richard, but the doctor will answer what he can. Regarding your RAM problem: The doctor suspects that your motherboard doesn't support 512MB DIMMs. You didn't say what chipset you have, but it sounds like an 815 chipset since it has integrated graphics and audio, has an AGP slot, and supports Coppermine P-IIIs. The 815 chipset supports a maximum of 512MB across all three DIMM slots and doesn't actually support a solitary 512MB DIMM. You'll have to trade that big boy with a friend, or buy two 256MB DIMMs. As far as the video goes, the 815 should automatically disable onboard graphics once you install an AGP device, but you may want to verify that the onboard graphics have been disabled by checking the BIOS and/or checking the Device Manager. Even the very old GeForce is more than enough to handle *Quake III Arena* at reasonable resolutions. Unless you're trying to game at anything over 1024x768, you really shouldn't have a problem—that is, of course, if you're running the latest Intel chipset drivers. To get the latest drivers, go to Intel's web site and search for the 815 chipset (assuming you have an 815). And while you're at it, download and install the latest nVidia drivers from nVidia.com. Finally, make sure you have the latest version of DirectX (www.microsoft.com/directx).**

**Replacing the onboard audio with a soundcard can certainly help the performance in games and other applications when you're saddled with a slow CPU. However, before you spend the cash, make sure you have the correct drivers for your onboard audio loaded, and that the audio problem is not a consequence of the issues discussed above. If you decide you want the improved audio of a discrete card, make sure you uninstall your audio drivers and turn off the onboard audio in the BIOS or via the motherboard jumper before you install the soundcard.**

**If you want to take some risks with your "new" computer, you can look to the dark art of overclocking your CPU for more performance. Since you can't unlock the multiplier on a P-III, you can only perform a bus overclock. Poke around the BIOS and see if it lets you set the bus frequency of your CPU. If it's on a 100MHz bus, you may have a little more luck than if it's 133MHz. (The 100MHz bus processor will simply have more overclocking overhead than the 133MHz bus versions.) If you can, bump up bus speeds in small increments. Going from 100MHz x 8 (800MHz) to, say, 110MHz x 8 would give you about 80MHz. You may have to apply more voltage to the CPU to reach higher speeds. Keep in mind that by overlocking you may kill your CPU, your motherboard, or any of the peripherals plugged into your mobo. If this is your main machine and you need it, then don't attempt to OC. If you have a backup PC, then go for it. Remember, if you break it, don't complain. Next patient.**



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## Drives A-Go-Go

I have four IDE drives: A 100GB Western Digital 1000JB, a Plextor PlexWriter 40/12/40A, a Plextor PlexCombo 20/10/40/12A, and a 60GB hard drive. How should I chain the drives? On IDE channel 1, I was going to run the 100GB HD as master, and the CD-RW drive as slave. On the second IDE channel, I was going to run the DVD-ROM drive as primary with the 60GB as secondary. The motherboard is a P4T-E, and I'll be running an Intel P4 2.4GHz with 512MB of PC800 RDRAM, a LeadTek GeForce3 TDH, a Creative Labs Audigy Gamer, all under Windows XP Home in a CoolerMaster ATC-201 case. What do you think of the configuration, and do you think a PC Power and Cooling Turbo-Cool 475 ATX-PFX would be enough to run all of this?

**— TOMMIE TAING**

**It's a nice config, Tommie. You probably won't need to upgrade much in the next six months, except for the videocard. Your plan to separate the optical drives from the hard drives makes good sense, especially for disc-to-disc burns. If you want to keep your optical drives on a separate IDE channel, you can get a slower, cheaper Promise ATA100 or even ATA66 card (optical drives don't demand the speed of a hard drive). That would keep all your devices on separate channels. In regards to the power, a 475 Turbo-Cool is more than enough.**

## What Are These Dots on My CPU?

I'm putting my first PC together and have been reading a reprint from the March 2002 issue ["Build It"]. My question is, How much thermal compound do I use? I'm using an AMD Athlon XP 2100+ and a CoolerMaster HHC-161. When I put the CPU in the motherboard, there are dots on it. Should I take these dots off? Or should I just cover the dots with the compound? Or should I take the compound and put it all over the heatsink.

**—MIKE STOKKE**

**If the "dots" are little rubber pads, leave them on. The four dots in the corners are to provide stability for the heatsink. The square thing in the center of the CPU is the core—the part that heats up. It's about the size of a pinky fingernail. If your heatsink has thermal tape on it, you don't need to apply compound. If it doesn't, you need to apply just a dab, a BB-size dab. You don't want to use so much that it oozes and insulates the core or shorts it out. If you want to be totally anal about the heatsink paste, follow the directions at www.arcticsilver.com. Also, be very careful when placing the heatsink on the CPU. If you put too much pressure on the core, you can chip or crack it, thus killing your proc. You want to apply light pressure to the heatsink, just enough pressure to clip the heatsink to the socket.**

## I Want to Build a New PC, but I'm Cheap

Could you suggest where to buy parts for a really cheap computer? I want to build a second computer on a tight budget. I want to hook it up to my stereo so I can play MP3s in my bedroom. Where can I find parts?

**—ALEX SCIUTO**

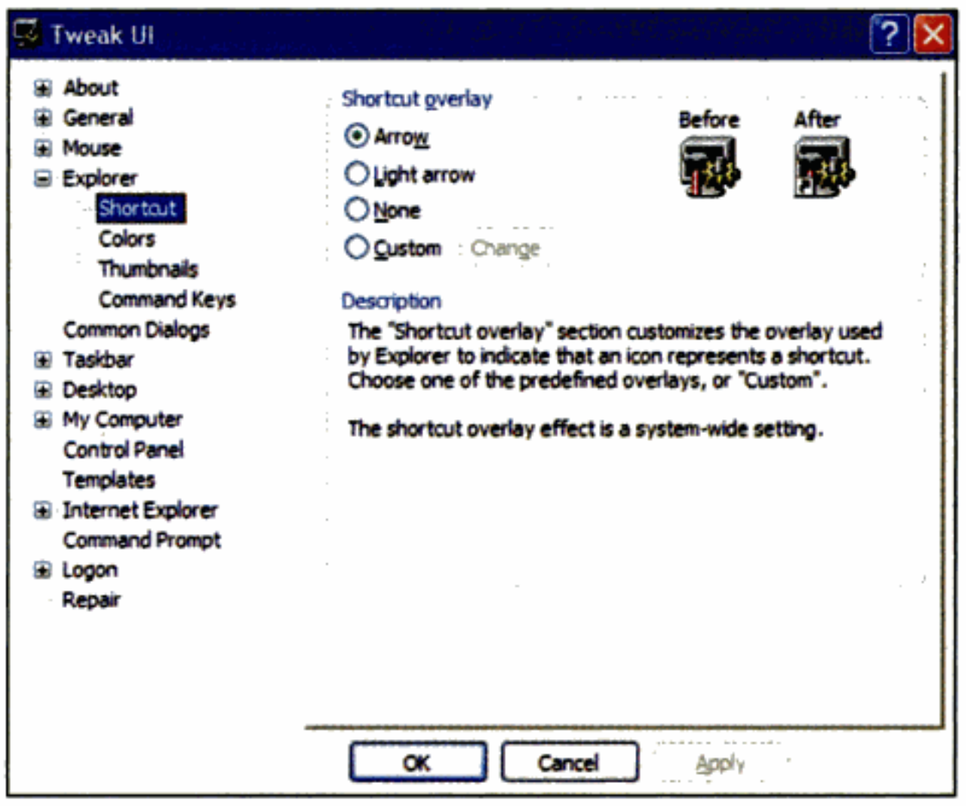
**When we're looking for cheap parts, we head to www.pricewatch.com and try to find one store that has most of the parts we want to buy (this way you'll be hit with just one shipping charge). If all you want to do is play tunes in your bedroom, get a nice big hard drive, a decent soundcard, and the cheapest CPU, motherboard, memory, and videocard you can find.**

**When you're shopping on Pricewatch, it's important to shop smart. Pay attention to shipping and handling charges, read the fine print, use a credit card that offers consumer fraud protection (*don't* use your debit card), and check with Resellerratings.com to see if there have been any complaints about your vendor.**

## What's the Optimal RAID Config?

Inspired by *Maximum PC*, I decided to build my first PC. I want to run RAID 0 with 120GB Western Digital drives. My question is, How many partitions should I run with a RAID 0 setup? While the article indicates that a single partition for the whole drive is preferred, I would like to know if a single partition is recommended for RAID 0 as well. I recently attempted to set up a partition, but I was thwarted when Windows XP Professional assigned my RAID array the partition letter "F." A Microsoft technician that I consulted with suggested that I disconnect the Zip drive, while reformatting the hard drives to remove any conflicts with the Zip. He also recommended that I create two partitions, one bootable 10GB for XP; then later format the remaining drive for storing data. What are your thoughts?

**—JOHN E. LEE**




***TweakUI* will let you modify all sorts of cool stuff, not just the shortcut overlay on your icons.**

**It all depends on how you want to use the drives in your system. If you plan on using the RAID array as the only mass storage in your system, you should format the whole array as a single partition. Too much performance is lost when you split a big RAID array into separate partitions.**

**Ideally, we like to install XP on a totally separate drive, then use the RAID array for our paging file, applications, and data storage.**

**As for changing drive letters in XP,**

***"When I put the CPU in the motherboard, there are dots on it. Should I take these dots off?"***

**that's easy. Head over to the Administrative Tools Control Panel, then go into Computer Management. From there, select Disk Management, and right click the drive bearing the letter you want to change. Select Change Drive Letter and Path, and make the adjustments you want to make. The OS will keep you from making any changes that will hose your system.**

## Shortcut Arrows Piss Me Off

I've had this question ever since Windows 98: How do you remove those ugly little arrows that appear over icons?

**—JONATHAN STEWART**

**Getting rid of the shortcut arrows is as easy as heading to Microsoft's web site and downloading *TweakUI*—the WindowsXP version is available at www.microsoft.com/windowsxp/pro/downloads/powertoys.asp.**

**Once you have *TweakUI* installed, fire it up and open the Explorer tree, then the Shortcut selection. Change the setting from "Arrow" to "None."■**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# How To...

**A step-by-step guide to tweaking your PC experience**

# TWEAK YOUR WINDOWS XP INTERFACE

Why leave "just good enough" alone?

**BY ANDY HUTCHINSON**

MAXIMUMPC
TIME TO COMPLETION
01:25
HOURS MINUTES

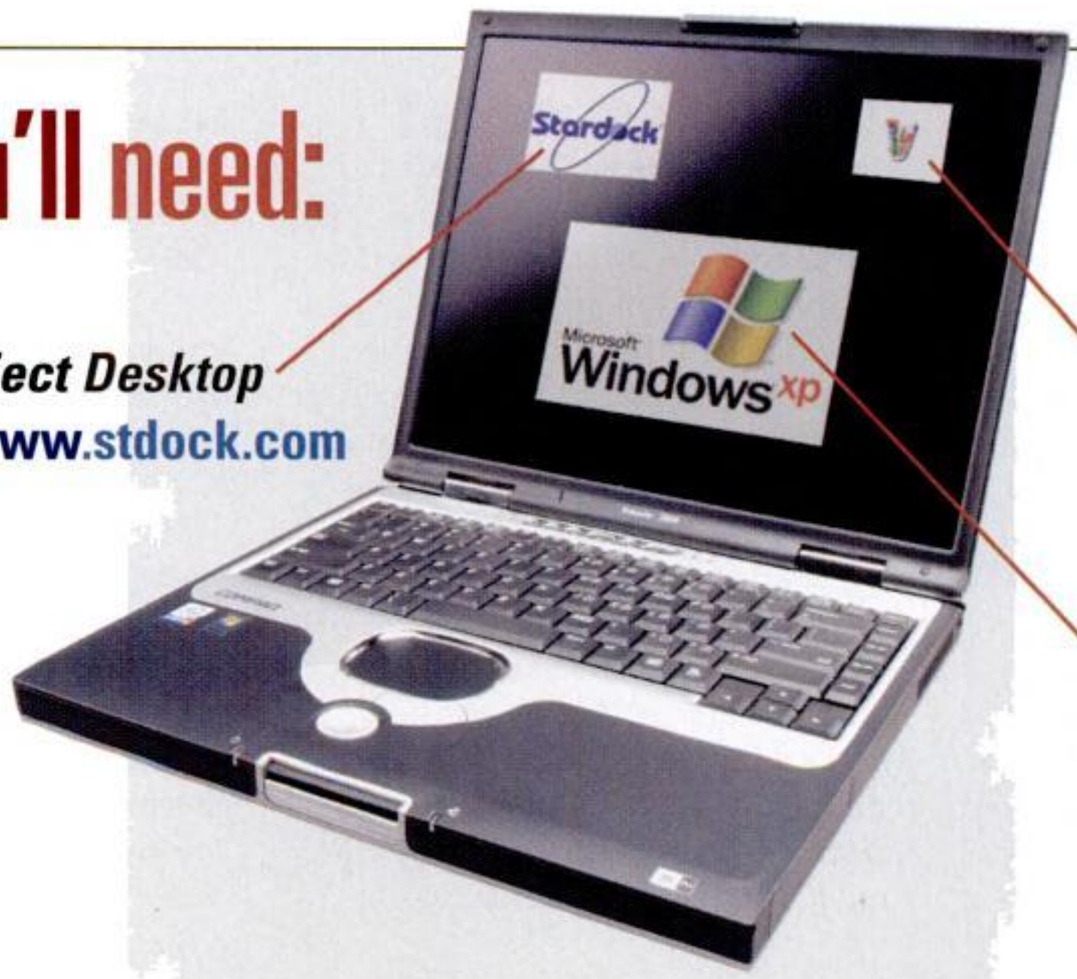
Ever since the earliest days of Windows, people have been skinning (that is, editing) the operating system's graphical user interface (GUI). Today, WinXP even includes features that change the default skin—you can choose either a classic Windows look or one of three new WinXP looks.

Of course, any schmuck can switch a few buttons in the Display control panel. But what if you want to make your Windows desktop look like BeOS or a Linux-based Gnome UI? The Windows theme utility won't let you do anything this fancy, but *WindowBlinds* will. This software allows you to change the bars, buttons, toolbars, and pretty much every other aspect of your PC's GUI.

By the time you're done with this article, you'll know the basics of skin creation; just be aware that this process could potentially damage your PC. So make sure you have a recent backup of your system, and that you back up all the UI files using *WindowBlinds* before you begin. If you're not comfortable with this level of tweaking, or aren't sure that your image editing skills are up to snuff, turn to page 54, where we show you how to modify your UI without risking doom.

## What you'll need:

- **Stardock's *Object Desktop* suite: $50 from www.stdock.com**
- **A bitmap editor (anything from *Photoshop* to *MSPaint* will work)**
- **A PC running Windows XP Home or Professional**



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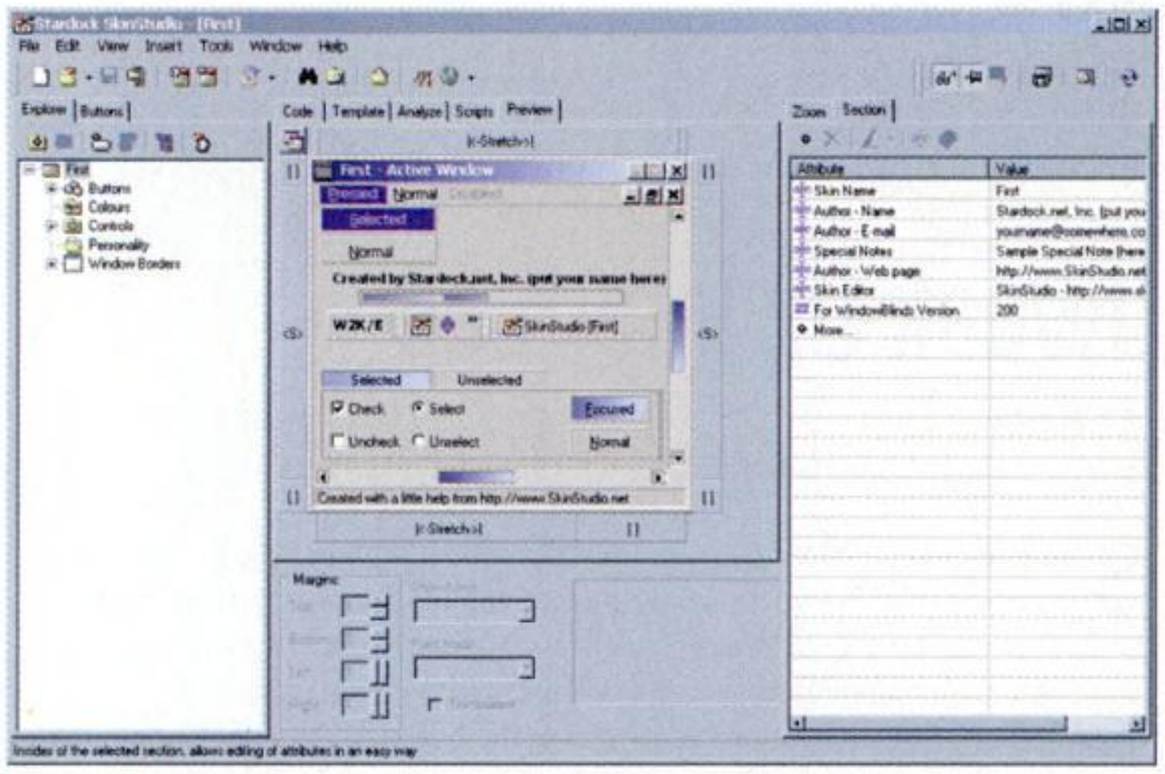
# Blinds, Buttons, and Bevels

Making skins for *WindowBlinds* used to be one hell of an undertaking, but Stardock's *SkinStudio* makes the process easy. This excellent application streamlines skin creation to the point where you can just point and click to achieve your creative goals. *SkinStudio* and *WindowBlinds* are both included with the *Object Desktop* suite.

After you've installed *SkinStudio*, the first thing you should do is create a base skin. Click the New button, then select New Skin Wizard. Select Gradient Style from the next dialog, then deselect Help, On Top and Rollup, to keep things nice and simple. Skip through the next two dialogs until you get to the Title bar text. Once there, choose Normal Text, No Shadow. Now just pick a name for your skin and click the Finish button.

The main *SkinStudio* interface is divided into four sections—the explorer panel on the left, the main viewer in the middle, the image-details viewer at the bottom, and the section panel on the right. As you tweak your skin using the section panel attributes, you'll be able to observe how everything looks when you make your changes.

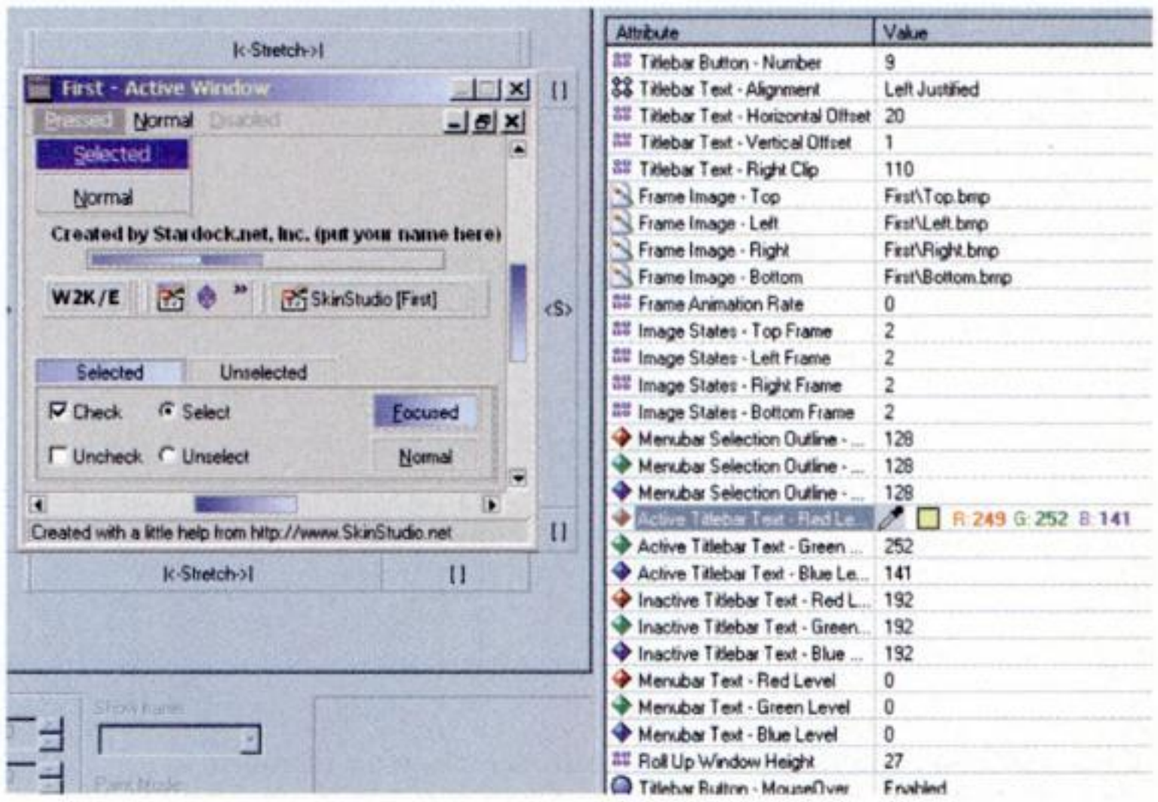
Let's start with a few basic tweaks. Click on Personality in the left-hand explorer panel. On the right you'll see a long list of attributes—we're interested in the color settings signified by a small diamond icon. Click the Active Title bar Text, then click the eyedropper and Select Color—pick a bright color. Now have a look at the preview window and you'll see that the Title bar text at the very top has changed. Don't worry too much about how it looks—we're just experimenting at this stage.



***SkinStudio* enables you to produce your own *WindowBlinds* skins with minimal grief, using an excellent point-and-click interface.**

## Pick a Color

Cast your eyes further down that list and you'll see that you can change the RGB color values of any of those main text attributes. *SkinStudio's* default skin is a dull, Windows-esque gray palette, and the default color settings reflect that. But when you start making your own unique creations, you'll be able to jazz up these settings according to your tastes.




**The color you choose for the title bar is heavily dependent on the image you use with it. Just adjust RGB values to change the color.**

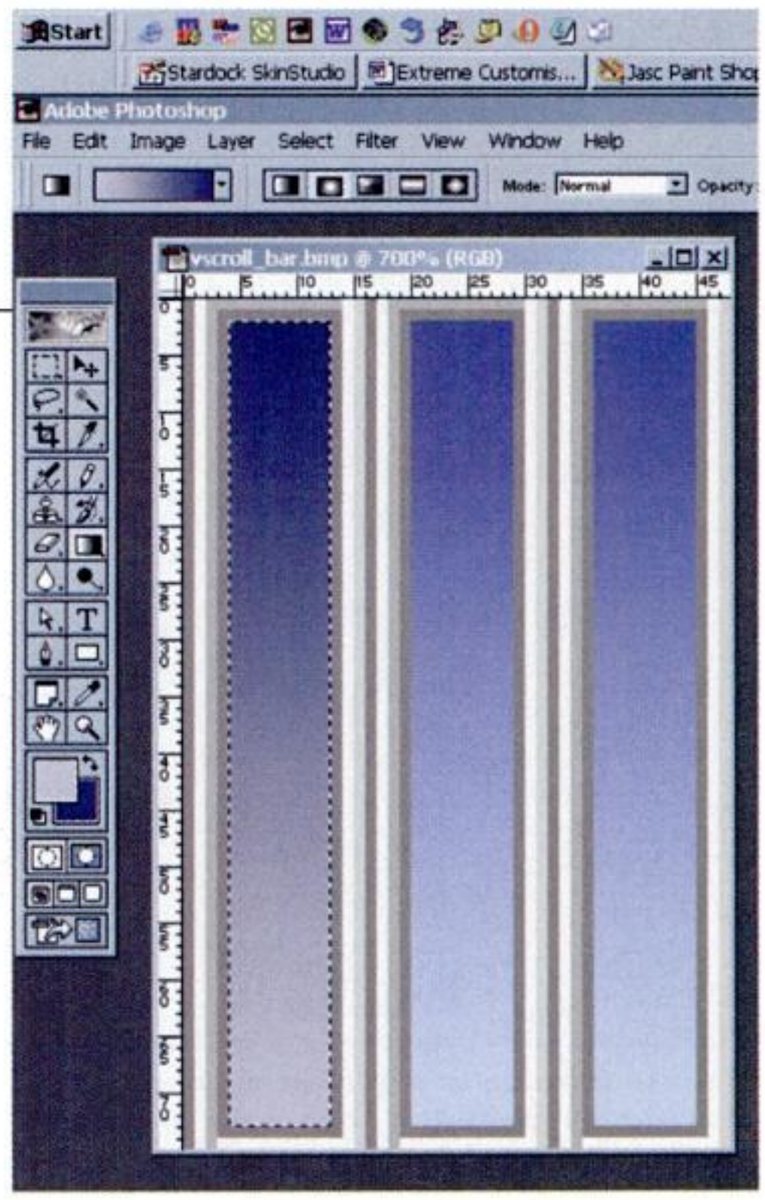
## Altered Images

Changing the text is easy. But how about modifying the actual bitmaps that define the interface? A substantial portion of a *WindowBlinds* skin is made up of bitmaps, and you can either create a completely new set or modify existing ones. At this stage we're going to stick with default sizes and simply change color. Let's begin with the scroll bar: In the middle preview window, double-click the scroll bar and the image will load your default image editor.

When the image opens, you'll see that there are actually three scroll-bar images. This is because *WindowBlinds* skins incorporate multiple states, such as "pressed" or "focus." You don't have to use those multiple states (the default skin doesn't, that's why the three images are identical), but you have to include them all. Zoom in on the image in your image editor. Now, carefully drag a selection marquee around the blue gradient.

The next step depends on the image editor you use. We used *Photoshop*, but you could just as easily do the same job in *Paint Shop Pro*. Use the gradient fill tool to fill the selection (we used R174, G187, B206 as the start color, and R23, G49, B86 as the end color). With the selection still active, copy and paste the gradient over the top of the other two scroll bars. Then simply flatten the image, reconvert it to Indexed Color, and save it. Finally, go back into *SkinStudio*, hit F5 to refresh the display, and you'll see your tweaked slider.

**Creating gradients requires a subtle hand. Experiment in *Photoshop* or *Paint Shop Pro* to see what looks good or bad.**



**The above panel lets you control how a button looks in any of its five states.**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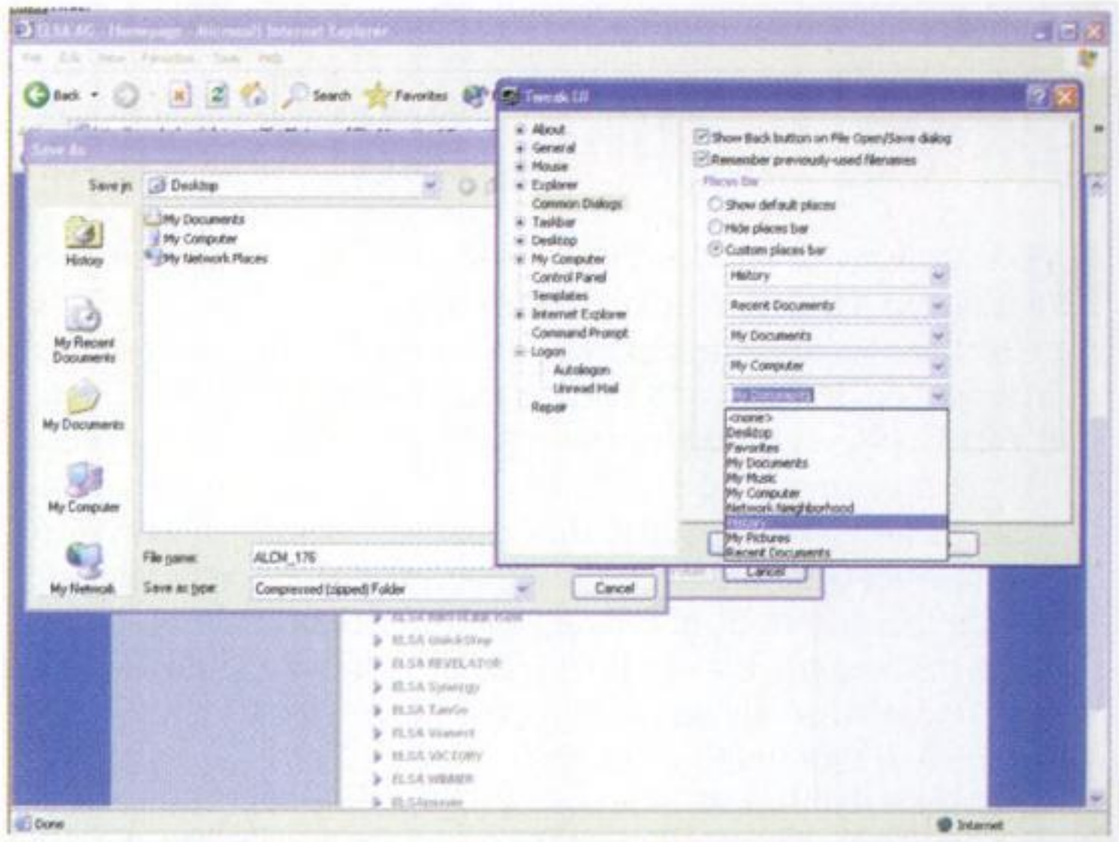
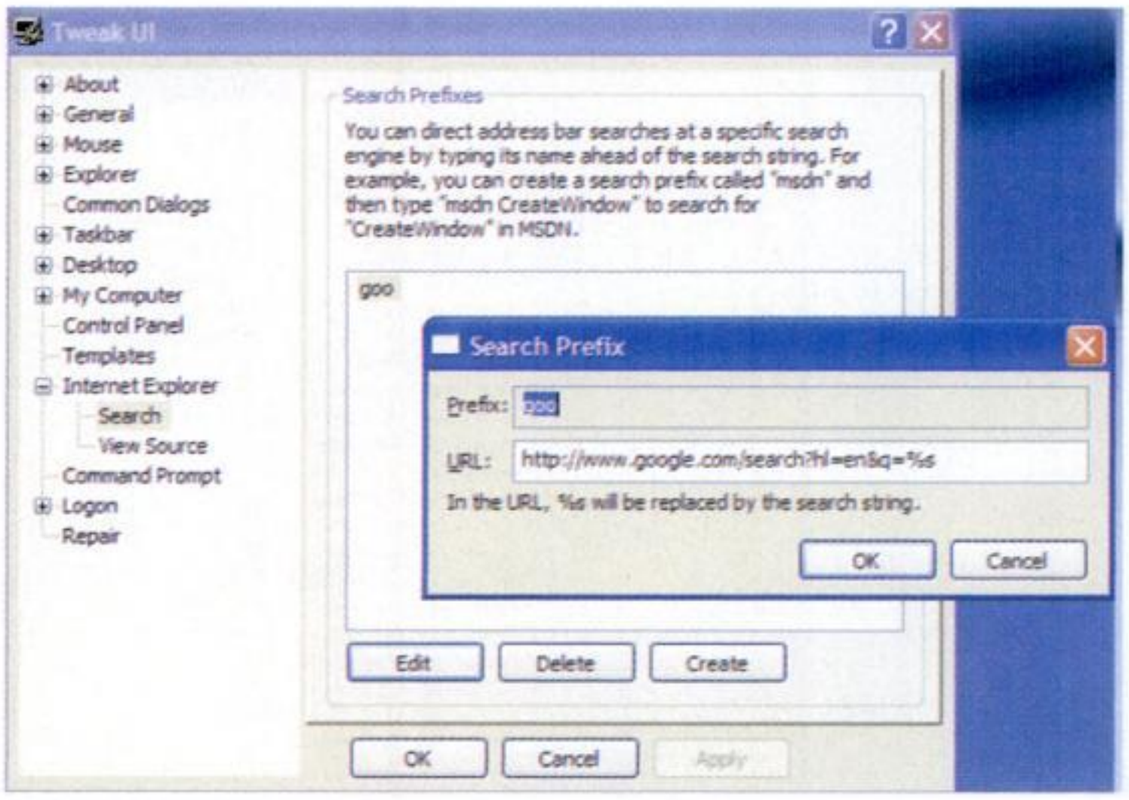
# Tweak UI: Interface tweaks for the masses

Since the days of Windows 95, Microsoft has made a series of unsupported PowerToys available for free download from the web. The latest batch of PowerToys is available from **www.microsoft.com/windowsxp/pro/downloads/powertoys.asp**. By far, our favorite is *TweakUI*. You can change dozens of settings with *TweakUI*, but here are the ones we think are the most useful.

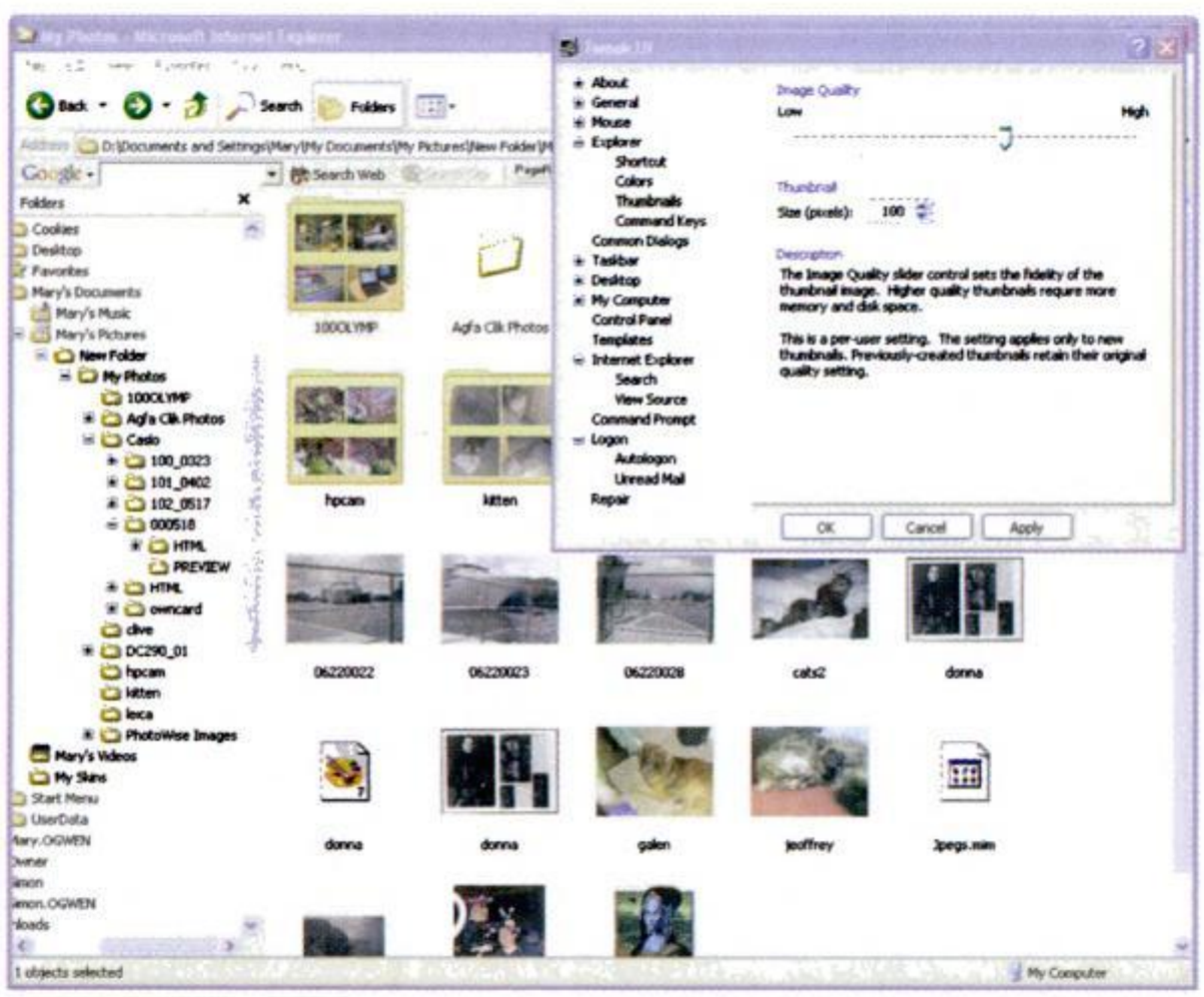



**Change the Places bar to show the folders that you actually find useful. You don't need Network Neighborhood if you've got just one PC, and Recent Documents might be more useful than My Computer.**

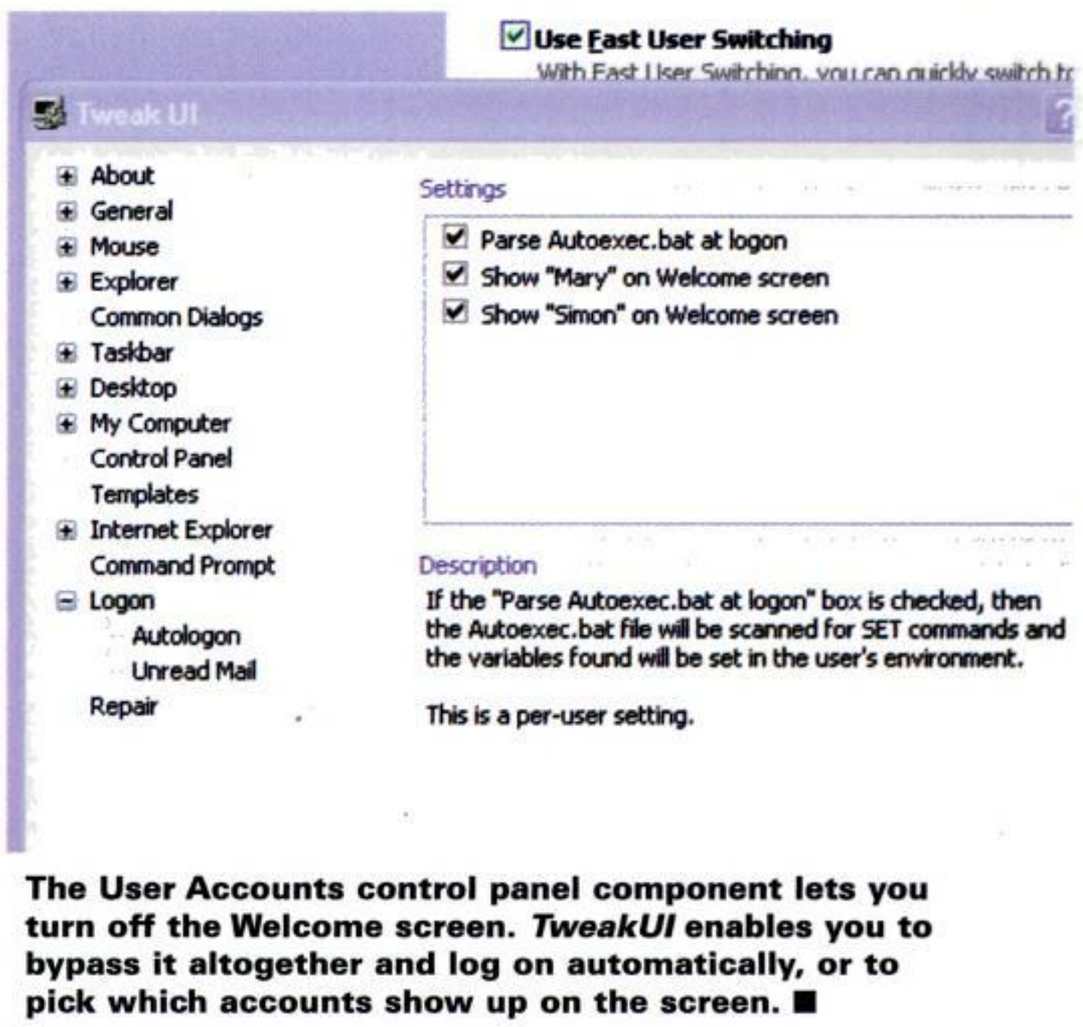



***TweakUI* can't make *IE6* address bar searches go straight to Google, but you can add a code word to make it work: Just open the Search window in *TweakUI*, then add this string to the URL field:** `http://www.google.com/search?hl=en&q=%s`**. Now, for example, any time you type** `goo "Austin Powers"` **into *IE's* address bar, it will send you straight to the Google results for "Austin Powers".**

**Here you can customize AutoPlay options to open files with your favorite program.**




**Choose the size and quality of your thumbnails. Quick-and-dirty thumbnails are better than none at all, or you can opt for better quality if you have ample space.**




**The User Accounts control panel component lets you turn off the Welcome screen. *TweakUI* enables you to bypass it altogether and log on automatically, or to pick which accounts show up on the screen. ■**



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ISSIONS +490% VIOLENCE +430.5% DEATHS +150% FAME +95.2% EGO -

+20% GREED +150% ENEMIES -95% DESTRUCTION +320% WEAPONS +200%

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Blood

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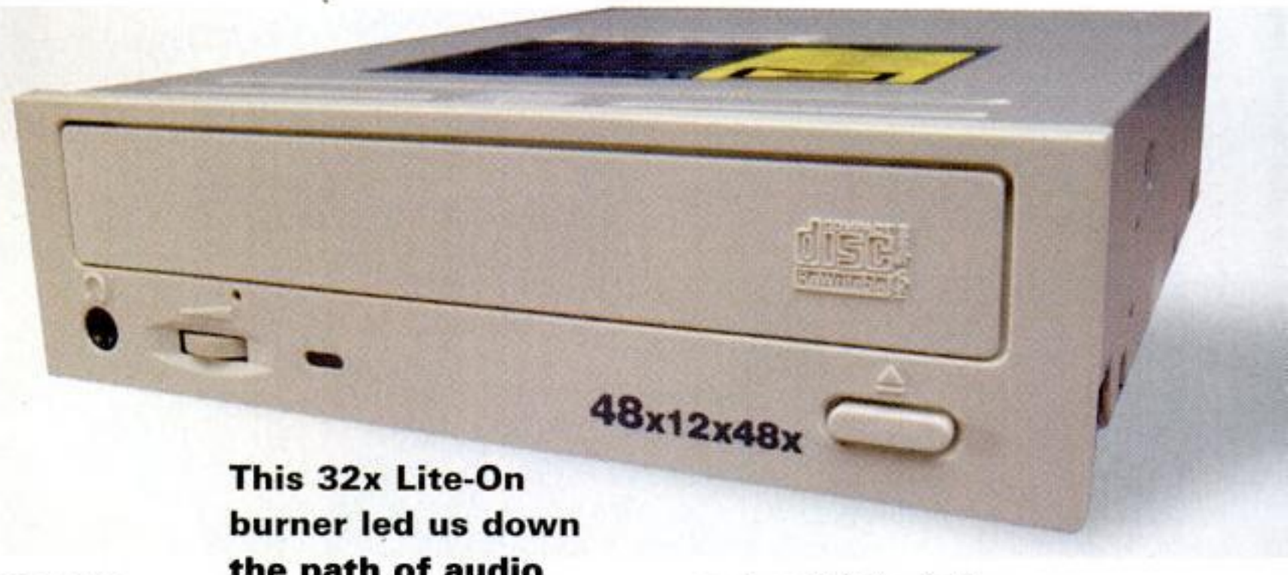
# In the Lab

**A behind-the-scenes look at Maximum PC testing**

## Audiograbber Plays Naughty

A hidden bug renders our recent audio extraction scores invalid. Here's the damage...

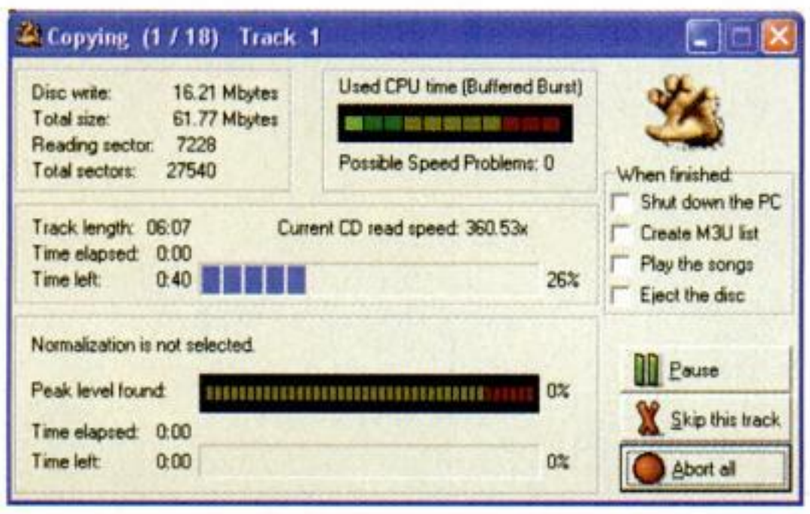
Just days before this issue of *Maximum PC* was to go to press, we discovered a flaw in our *Audiograbber* digital audio extraction benchmark. It seems that when *Audiograbber* extracts audio from a Lite-On optical drive installed in a system running *Intel Application Accelerator 2.0*, some of the ripped tracks can end up garbled or devoid of any sound whatsoever. The problem seems to occur with drives rated in excess of 32x when ripping tracks at the maximum or default setting.




**This 32x Lite-On burner led us down the path of audio extraction madness.**

We discovered the bug after we began noticing some astoundingly quick rip times. In one case, for example, we extracted the music from a full audio CD in just 72 seconds. Alarmed by a series of record-breaking extractions, we began listening to the ripped tracks, and were shocked by what we heard: Tracks from the middle of the CD were essentially worthless.

You might be wondering why we never caught the bug before. The fact is, when checking digital audio extraction results, we've typically listened to just the first and last tracks of any ripping session, because these are the tracks that are most likely to suffer errors. We had grown complacent and had quit listening to the middle tracks of a ripped CD—the very tracks affected by the *Audiograbber* bug.




**Clearly, the Lite-On drive is incapable of achieving 360x extraction speeds.**

After discussing the bug with the programmers who wrote *Audiograbber*, we were able to fix the problem by installing the Adaptec ASPI manager from **www.adaptec.com**. Unfortunately, this fix comes about four months too late. Since the July issue, we've been comparing the audio extraction performance of OEM review systems to that of our *Maximum PC* zero-point system—a system that just so happens to have been running a 32x Lite-On drive and *Intel Application Accelerator 2.0*.

Now, as luck would have it, very few of our recent system reviews were affected by the invalid benchmark. Here's the damage: In the August 2002 issue, we gave some unearned praise to a Monarch system for ripping an entire CD is just 73 seconds. Then, in the September 2002 issue, we reported a similarly improbable score of 74 seconds achieved by our own Dream Machine 2002. Unfortunately, the Monarch system was shipped back long ago, and the Dream Machine has been dismantled and redistributed across numerous other Lab experiments, so neither machine can be rebenchmarked.

The MicronPC review on page 58 of this issue is also affected by the *Audiograbber* bug (this review was sent to press before we discovered the problem). For the report you're currently reading, however, we were able to rebenchmark the MicronPC's Lite-On DVD-ROM drive with the Adaptec ASPI drivers loaded in, and got a score of 150. We also rebenchmarked our zero-point system with the ASPI drivers loaded, and got a score of 151 seconds. This new zero-point score is 40 seconds slower than the zero-point score we've been improperly reporting for the last four months.

Rest assured, readers, we haven't docked any review systems a verdict point for anything ripping-related. You can expect to see an updated, bug-free zero-point benchmark chart in our December issue.

### Unreal or Unreliable?

*Audiograbber* isn't the only benchmark giving us trouble these days. While running tests for this month's Athlon XP cover story, we found that the beta version of the *Unreal Tournament 2003* benchmark seems to have cross-platform issues. Although the demo consistently runs the same content from machine to machine, the content differs between P4 and Athlon platforms (at least this is the case with our 14.57 beta demo version).

Does this discovery affect any previous *Maximum PC* content? No. We used the beta demo in last month's gaming rig showdown, but each of those systems shared a common Pentium 4 platform. We did, however, drop *Unreal Tournament 2003* from the battery of tests used in this month's AMD vs. Intel cover story. Hopefully, the problem will be fixed in the release version of the demo.



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# Analog Media? Sort of.

When we first saw Verbatim's new "Digital Vinyl CD-Rs," we were all taken aback. They may be just regular old CD-Rs on the inside, but on the outside, they're mocked up to look like classic 45rpm records. Verbatim says the Digital Vinyl will appeal to people who are archiving older LP records, but we think anyone who grew up before the age of the audio CD will appreciate the product design nostalgia. Even better, the Digital Vinyl CD-R is rated for 100 years of storage. The discs will hold 700MB of data, or 80 minutes of audio. The price is $1.49 per CD-R or $13 for a 10-pack. For info, go to **www.verbatim.com**.

**It looks like vinyl, but don't try scratching on it.**

# RIMM4200: Dead or Alive?

When we built Dream Machine 2002 with RIMM4200 memory modules, the nascent Rambus sticks didn't look like they were going to make it past the new year. Well, there's good news: RAM companies large and small are throwing support behind the technology.

A stick of RIMM4200 combines two 16-bit RDRAM modules into a single 32-bit module. Kingston (**www.kingston.com**) is offering both RIMM3200 and RIMM4200 parts. A non-ECC 256MB RIMM3200 will run $112, while the faster PC1066-based RIMM4200 version will run $197. OCZ (**www.ocztechnology.com**) says it's also offering support for the 32-bit RDRAM modules, but at outrageously fast PC1200 speeds. In fact, the company is now selling "RIMM4800" modules in 128MB and 256MB sizes, with 512MB on tap. Although Intel's 850e chipset doesn't support 1200MHz rates without overclocking, SiS's upcoming R658 chipset will.

# Best of the Best

As of November, 2002

Here are our current top picks for each hardware category. Red text indicates first month on chart. Check back next month for updates.

**High-end videocard:**
ATI Radeon 9700 Pro
**Budget videocard:**
Gainward GeForce4 PowerPack! Ultra/650XP Golden Sample (GeForce4 Ti 4200)
**Do-everything videocard:**
All-In-Wonder Radeon 8500DV
**Soundcard:**
Sound Blaster Audigy Platinum
**Hard drive:**
Western Digital 1200JB
**CD-RW drive:**
TDK VeloCD-401248
**LCD monitor:**
Sharp LL-1820
**CRT monitor:**
Sony F520
**P4 motherboard:**
Asus P4T533-C/P4T533
**Athlon XP motherboard:**
Asus A7V333
**Consumer DV camera:**
Sony DCR-TRV17
**Portable MP3 player:**
Creative Nomad Jukebox 3
**Photo printer:**
Epson Stylus Photo 1280
**Palm PDA:**
Sony Clie PEG-N760C
**Pocket PC PDA:**
Toshiba e740 Pocket PC
**5.1 speakers:**
Klipsch Promedia 5.1
**4.1 speakers:**
Logitech Z-560
**2.1 speakers:**
Klipsch Promedia 2.1

**Our current gaming favorites:** *Battlefield 1942, Neverwinter Nights, Warcraft III: Reign of Chaos*

# "So I switched to PC"

We've all seen the ads: Apple weirdos blathering on about why they switched to Macs. Blah, blah, blah. What you may not know, however, is that a number of interviewees misunderstood the casting call and ended up explaining why they switched from Macs to PCs. We got ahold of some of these "outtakes," and submit them for your perusal.

**"When I started at the design firm, my Mac was the fastest machine in the company for the work that I do. But then I got transferred out of the Gaussian blur department."**

**"When Apple demanded payment for the e-mail address and storage they gave me, I suddenly realized who the *iTools* were. I switched to PC."**

**"I never really got into the whole 'computer gaming' thing when I had my Mac. It just seemed really hokey. But then a PC friend of mine showed me some stuff he was playing, and I gotta tell you, it was nothing like *Tetris*!"**



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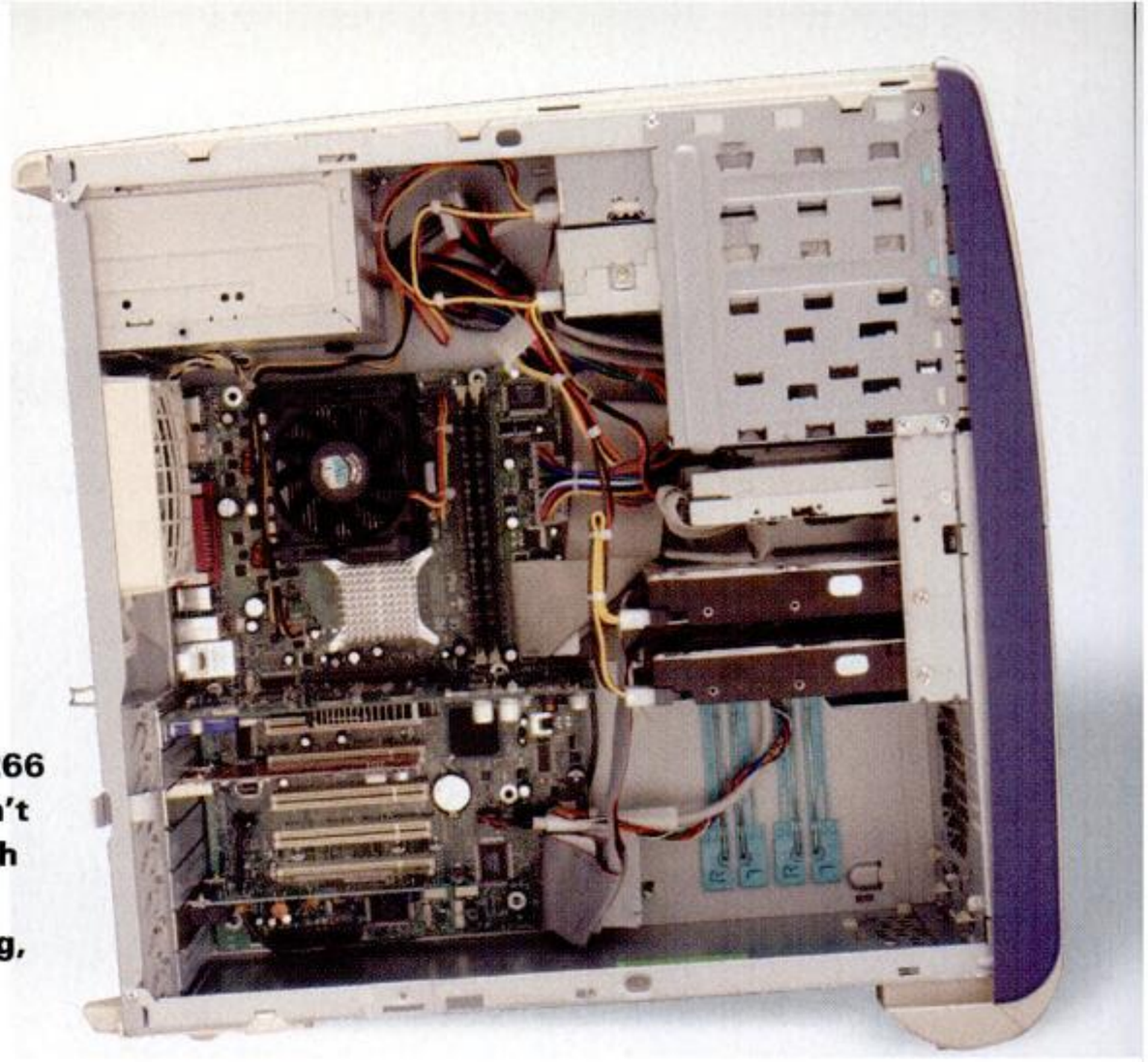
# MicronPC Millennia TS2 Pro

DDR memory alone can't account for a sad showing



**Low-bandwidth DDR266 memory can't keep up with the P4. Are you listening, Intel?**

It certainly takes balls to submit a Pentium 4 rig with 266MHz DDR memory in this age of 1066MHz Rambus, so we wasted no time in benchmarking the Millennia to see how it would fare. The results? Micron's rig performed better than expected, but still lagged behind today's top P4 systems. Low-bandwidth DDR memory, however, wasn't the sole culprit.

Our review system's config was a mixed bag. We dig the inclusion of Intel's 2.8GHz P4, and we're just as enthusiastic about the Intel motherboard that it's plugged into. The custom-designed D845EBT is one sweet mobo, integrating FireWire, USB 2.0, and a Promise RAID controller. MicronPC used the RAID controller to stripe together two 120GB Western Digital hard drives for increased performance. Unfortunately, the company chose the 1200BBs (which boast a 2MB cache) rather than the 8MB 1200JBs.

It's too bad MicronPC followed Intel's mandate to use only DDR266 memory with the 845E chipset, because the Millennia could've definitely benefited from the added bandwidth of DDR333 or DDR400. At just 256, the Millennia's *SYSmark2002* score is lower than that of many 2.5GHz/RDRAM-based boxes we've tested. Sure, one could argue that the latest version of *SYSmark* pays undue attention to memory bandwidth (see page 12), but you know you've got problems when your rig is beaten by PCs with a 300MHz processor speed deficit.

The Millennia's GeForce4 Ti 4600 videocard is another red mark—we expect nothing less than an ATI Radeon 9700 in a high-end PC. But just when we were ready to write off the Millennia's performance, it shocked us by dominating our *Premiere* benchmark, completing it in a mere 408 seconds! That's still behind what Athlon systems are pushing, but it trumps Dream Machine 2002, which cruises on a 600MHz FSB and 1200MHz memory.

Pioneer's DVD-R drive is a commendable choice, and MicronPC also threw in a Lite-On 16x DVD drive. However, the lack of a CD-RW drive means you'll have to use the DVD-R drive for CD burning, resulting in longer burn times. And the Lite-On's digital audio extraction results in *Audiograbber* are nowhere near what today's high-speed CD-RWs are posting. As for the Millennia's sound subsystem, MicronPC eschewed the industry-standard Audigy in favor of onboard sound. The integrated SoundMAX chip's output can't even match the quality of a Sound Blaster Live!, much less that of an Audigy. Worse, the audio solution is rounded out by tinny-sounding Altec Lansing speakers—what about Klipsch?

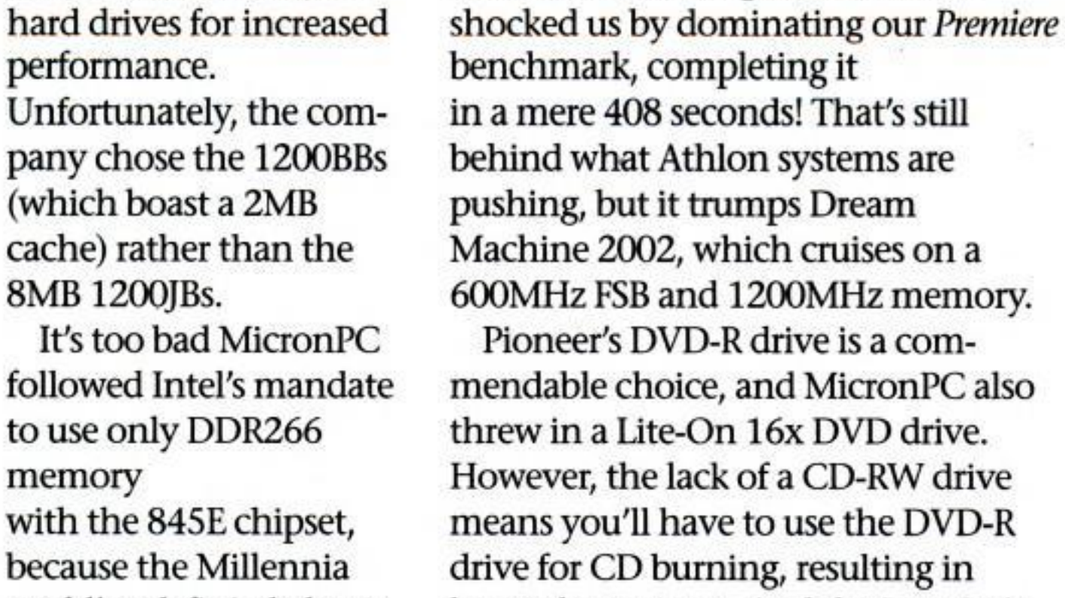
The dubious configuration is capped off by cooling problems. After about an hour of benchmarking, the Millennia's case was alarmingly hot. There was just one insufficient case fan for the entire system. In fact, the hard drives were so searing, we couldn't touch them for longer than a few seconds. This will almost certainly shorten the life of the system, so MicronPC definitely has some work to do. The software bundle, on the other hand, is a rosier scenario—the inclusion of *Office XP Small Business Edition* and *Norton AntiVirus 2002* is a nice touch.

In the end, the MicronPC Millennia TS2 Professional is a computer that could have been, should have been, might have been. And the DDR memory is only partly to blame.

**—OMEED CHANDRA**

## UNDER THE HOOD

| | |
|---|---|
| **THE BRAINS** | |
| **CPU** | 2.8GHz Intel Pentium 4 |
| **Mobo** | Intel D845EBT |
| **RAM** | 1GB DDR266 SDRAM |
| **I/O ports** | Six USB 2.0, four FireWire, PS/2 mouse, PS/2 keyboard, parallel port, serial port, line-in, mic input, VGA, DVI, three analog out, digital audio out |
| **NETWORKING** | |
| **LAN** | Onboard Intel 10/100Mbps Ethernet |
| **DISPLAY** | |
| **Videocard** | GeForce4 Ti 4600 128MB |
| **Monitor** | Sony CPD-G410R 19-inch CRT |
| **STORAGE** | |
| **Hard drives** | Two 120GB Western Digital WD1200BB (2MB cache), joined in RAID 0 with a Promise ATA/100 RAID controller |
| **DVD-ROM** | Lite-On LDT163 DVD-ROM |
| **DVD-RW** | Pioneer DVR-A04 DVD-RW |
| **SOUND** | |
| **Soundcard** | Integrated SoundMAX digital audio on mobo |
| **Speakers** | Altec Lansing 5100 5.1 speakers |
| **FINE DETAILS** | |
| **Fans/extras** | One 80mm rear case fan, Pinnacle Studio DV capture card |
| **Mouse** | Microsoft Wheel Mouse Optical USB |
| **Keyboard** | Microsoft Internet Keyboard |
| **BUNDLE** | |
| Windows XP Home, Microsoft *Office XP Small Business Edition*, Sonic *MyDVD 3.0*, Pinnacle *Studio 7 SE*, nVidia *NVDVD Soft DVD Player*, Nero *Burning ROM 5.5.8.1*, *Norton AntiVirus 2002* | |
| **BOOT: 64 sec** | **DOWN: 8 sec** |




*Our zero-point system includes: an Intel D850MV motherboard, a 2GHz P4 CPU, 512MB PC800 RDRAM, a GeForce4 Ti 4600 videocard, and a Western Digital 1000BB hard drive (2MB cache).*

## MAXIMUMPC VERDICT

***Millennia TS2 Professional***

MICRONPC

**+ GEORGE HARRISON ON GUITAR**

Surprisingly good *Premiere* performance, a solid software bundle, and a pretty cool motherboard.

**– RINGO STARR ON DRUMS**

Lackluster performance in most benchmarks, 266MHz memory, onboard sound, wimpy speakers, excessive heat, and no Radeon 9700.

**www.micronpc.com**

**$3,500** incl. monitor & speakers

**6**



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# Vantec EZ Swap MRK-102FD

Swapping hard drives isn't just good, it's VanTASTIC!

Removable hard drive racks save you the trouble of breaking into your case every time you want to add or remove a hard drive. Instead, you just pluck your hard drive from the front-mounted rack, slide in a new drive (if you're so inclined), then go about your merry way. Unfortunately, early IDE hard drive racks were shoddy and impractical—two pitfalls that the Vantec EZ Swap avoids, and then some.

We immediately nodded with approval when we saw the EZ Swap's solid aluminum construction and sleek design. Once we had it installed, we marveled at the rack's sundry features. The EZ Swap includes a temperature sensor, a backlit digital display for temperature readings, a clock that shows the hard drive's up-time, a 40mm rear fan, and a lock and key for security. All of this is just plain genius. In fact, some staffers thought these amenities were so cool, they'd install the EZ Swap even if they never before considered taking their drives out of their PCs.

Lock and key security features are nothing new, but the EZ Swap has a special three-step lock. The two steps you'll use most are full-lock and unlock, but there's also a middle step that allows you to power off the drive without unlocking it. That means you can put your machine in standby mode, power off the drive, and completely deny information thieves any access to your files (just make sure your motherboard supports a powered-down drive in standby mode, or you'll get a nasty error message).

The EZ Swap is a damn good product, but it's not perfect. When docking the drive, it's sometimes difficult to tell if it's fully locked in, and we think the front handle could have been better constructed. It also would have been nice if this thing supported hot-swapping (like the Promise SuperSwap 1000 does). In fact, we would've given the EZ Swap a Kick Ass Award if it were hot-swappable, or $10 cheaper. Regardless: The display *rocks*, the security *locks*, it looks like a *fox*, and it'll knock off your *socks*.

**The silver button on the far right flips out to the left to reveal a hidden lock that can keep your drive from being stolen.**

**MR. SPACELY:** Backlit digital display, a temperature monitor, and a great security options.

**MR. SLATE:** Questionable lockdown and no hot swap.

**—JOHNATHAN D. MCKINNEY**

**MAXIMUM PC VERDICT: 8**

$40, www.vantecusa.com


REACH A NEW LEVEL
WITHOUT PRACTICE, LUCK, OR ULTRA-SECRET CHEAT CODES.

**Thin speakers. Tight, deep bass. And a really cool control center. How can you lose?**

Whether you're exploring new frontiers in gaming or grooving to your favorite songs, Monsoon's Planar Media™9 and Planar Media™7 audio systems plunge you into new depths of immersive experience. Both systems connect easily to your computer or gaming console, or your portable CD, cassette or MP3 player. Both feature Level 9™ Planar Ribbons with PFT.™ And both will elevate your entertainment options to a whole new plane.

MONSOON

Drenched In Sound

monsoonaudio.com

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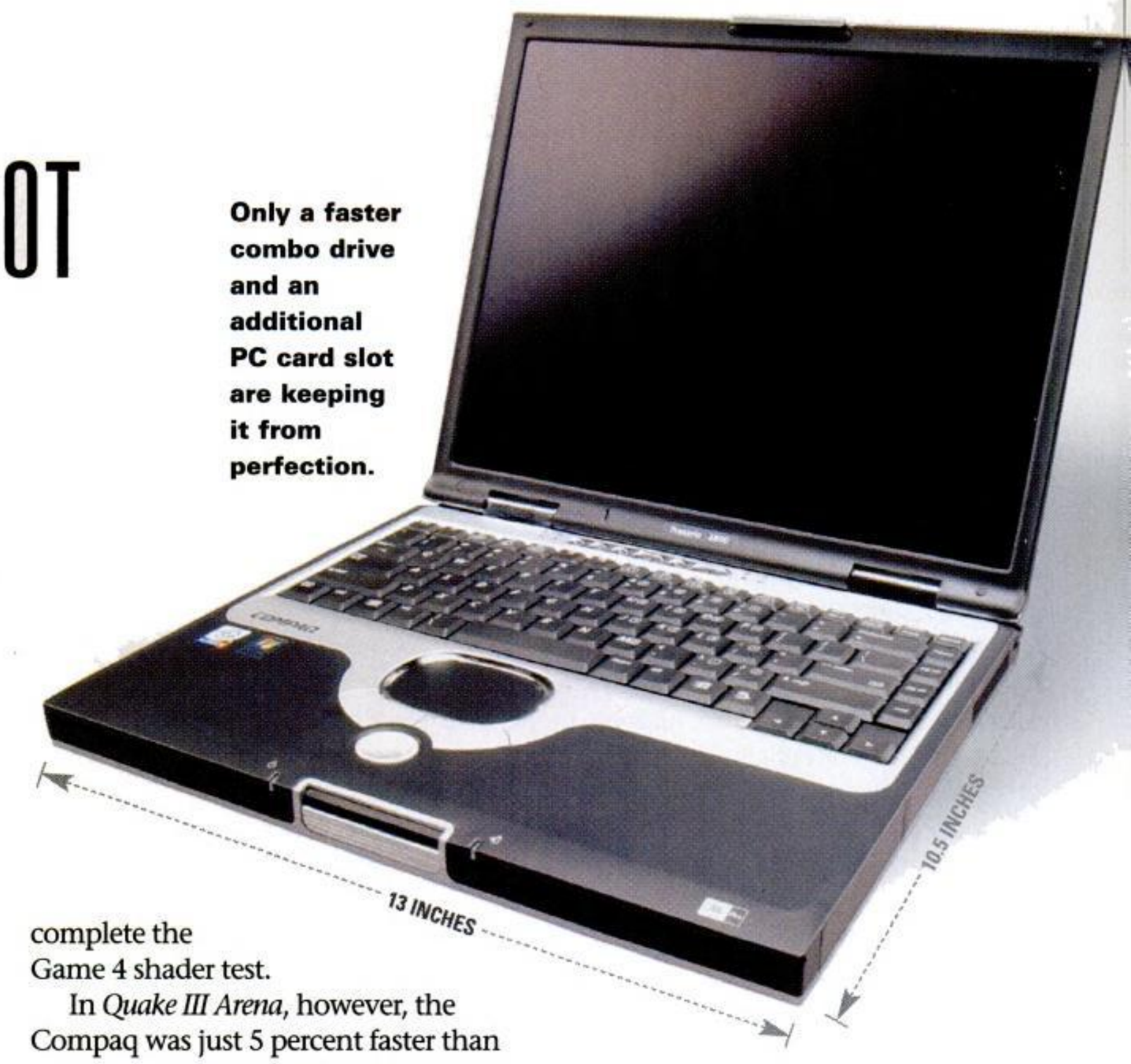
# Compaq Presario 2800T

## Programmable 3D shaders and skinny to boot




**Only a faster combo drive and an additional PC card slot are keeping it from perfection.**

Thin-and-light notebooks might be easy to tote around, but they've never offered much of a gaming experience. Compaq's new 2800T, however, offers an awfully strong fun-to-weight ratio. While it's not as dainty as the typical thin-and-light, the Compaq is still low-profile and gives you a 2GHz Pentium 4, a combo CD-RW/ DVD-ROM drive, and USB 2.0 support. The Compaq also goes with a safe-and-steady Intel 845MP chipset and 512MB of DDR266.

But the big deal here is the Mobility Radeon 9000 video chipset. Based on the Radeon 8500 core, the latest Mobility chipset is the first notebook video solution to include support for pixel and vertex shaders.

So what's the upshot? Let's let id programmer John Carmack explain it in his own words: "The (Mobility Radeon 9000) allows the current generation of games to run at their absolute highest fidelity settings, and it's capable of running the coming generation of games." The new Mobility Radeon 9000 is not only the fastest mobile chip for current 3D games, it's also the only current mobile chip that can render special shader effects.

In August, we reviewed an Alienware notebook armed with a 2.4GHz desktop P4 and Mobility Radeon 7500 video chipset. In gaming benchmarks, the Compaq 2800T not only blew away the Alienware, it also humbled our zero-point 1.7GHz Dell Inspiron 8200 (which is equipped with a GeForce4 Go 440 chipset). The Compaq spit out 30 percent more performance than both the Alienware and the Dell in *3DMark2001*, and the Compaq was of course the only notebook that was able to complete the Game 4 shader test.

In *Quake III Arena*, however, the Compaq was just 5 percent faster than our zero-point notebook. OpenGL performance was never a strong suit of the 8500, and it doesn't appear to be a strength of the Radeon Mobility 9000 either—at least in *Quake III Arena*. We ran our *Jedi Outcast* benchmark (which is normally reserved for desktop testing) on both the zero-point Dell and Compaq 2800T, and the Dell hit 30fps while the Compaq hit 41.8fps. This is a bump of about 37 percent.

In application benchmarks, the Compaq did well (as expected) against the 1.7GHz zero-point notebook, but trailed the 2.4GHz Alienware. But unlike the Alienware, the Compaq isn't an obscene juice hog. While the Alienware could muster just 75 minutes of DVD playback, the Compaq gave us a respectable 127 minutes. A second battery can also sub for the Compaq's optical drive for more run time. With the second battery, it's possible the Compaq could approach the run-time of our Dell Inspiron 8200, which runs a whopping 235 minutes with both batteries in place.

Other Compaq amenities include a glide-pad, an "eraser nub" controller, and a 15-inch LCD screen that supports 1600x1200. The screen doesn't provide the same great off-axis viewing as the Inspiron 8200's UltraSharp screen, but it does give you more resolution than you'll ever find in a 15-inch desktop LCD.

The Compaq is a new breed of PC notebook—it has the CPU and 3D rendering power of a desktop replacement, yet is almost light enough to carry around on an everyday basis.

**—GORDON MAH UNG**

### UNDER THE HOOD

| | |
|---|---|
| **THE BRAINS** | |
| **CPU** | 2GHz Pentium 4-M (512K full-speed L2 cache)<br>Using Intel 845MP chipset |
| **RAM** | 512MB DDR266 |
| **I/O ports** | One Cardbus PC Card slot, one VGA, one S-video, one parallel, two USB 2.0 ports, mic-in, headphone, IrDA, Fast Ethernet |
| **NETWORKING** | |
| **Modem** | Lucent WinModem 56K |
| **LAN** | Intel Pro/100 VE Network Connection |
| **DISPLAY** | |
| **Video** | ATI Mobility Radeon 9000 (64MB DDR) |
| **Display** | 15-inch |
| **Max res** | 1600x1200 |
| **STORAGE** | |
| **Hard drive** | IBM Travelstar 60GB (5400 RPM) |
| **CD/DVD** | Teac DW-224E (8x DVD, 8x CD-R, 4x CD-RW, 24x CD-ROM) |
| **SOUND** | |
| **Audio chip** | Integrated AC97 audio, Sound Max 3.0 |
| **TIPPING THE SCALES** | |
| **Lap weight** | 6.65 lbs |
| **Carry weight** | 7.45 lbs |
| **BUNDLE** | |
| Microsoft Windows XP Home, *WinDVD*, Roxio *EasyCD Creator*, *Microsoft Works* | |
| **BOOT: 60 sec** | **DOWN: 10 sec** |

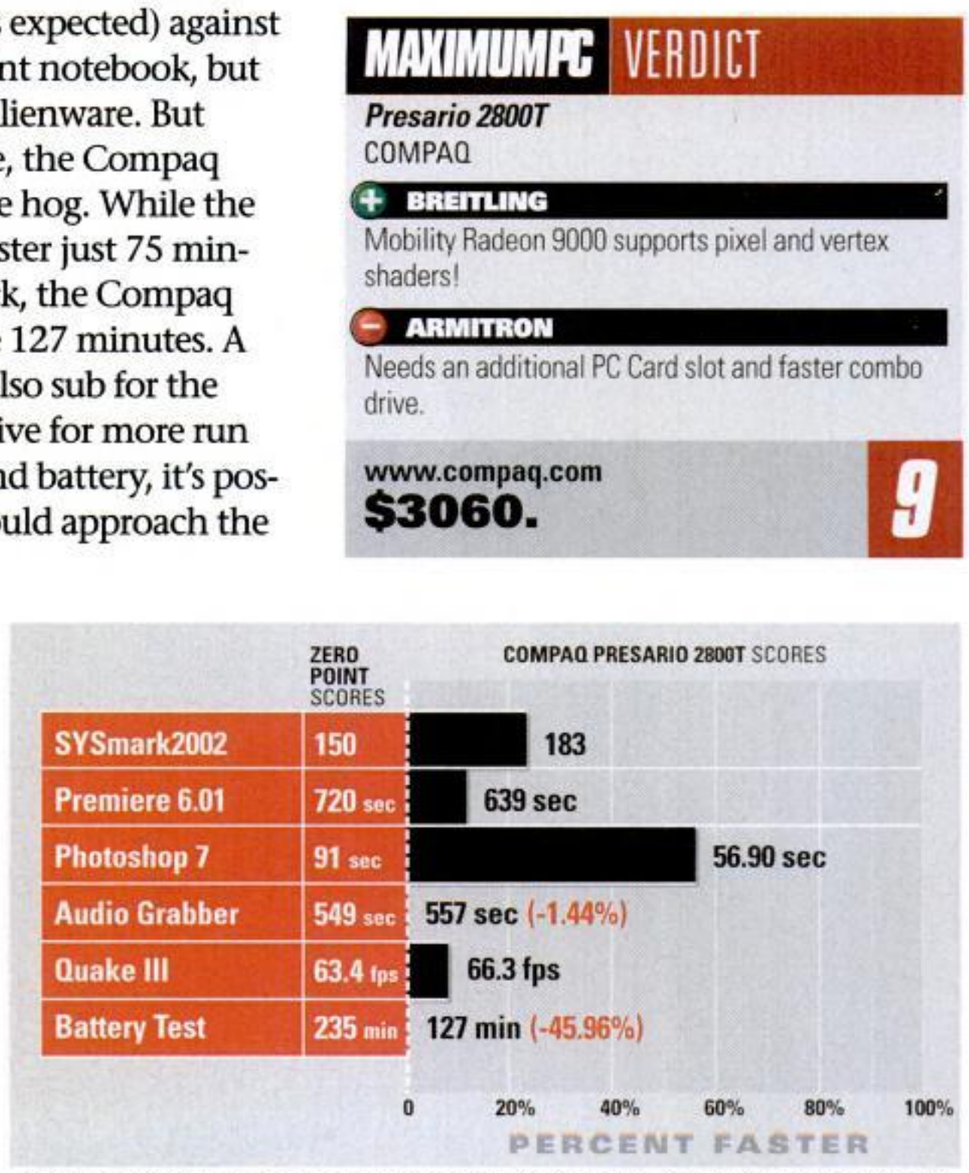
### MAXIMUMPC VERDICT

***Presario 2800T***
COMPAQ

**+ BREITLING**
Mobility Radeon 9000 supports pixel and vertex shaders!

**– ARMITRON**
Needs an additional PC Card slot and faster combo drive.

**www.compaq.com**
**$3060.**
**9**




*Our zero-point notebook is a Dell Dimension 8200, and includes a 1.7GHz P4-M CPU, 256MB DDR266, a 64MB 128-bit DDR GeForce4 Go graphics chipset, and a 5400rpm IBM Travelstar 60H hard drive.*



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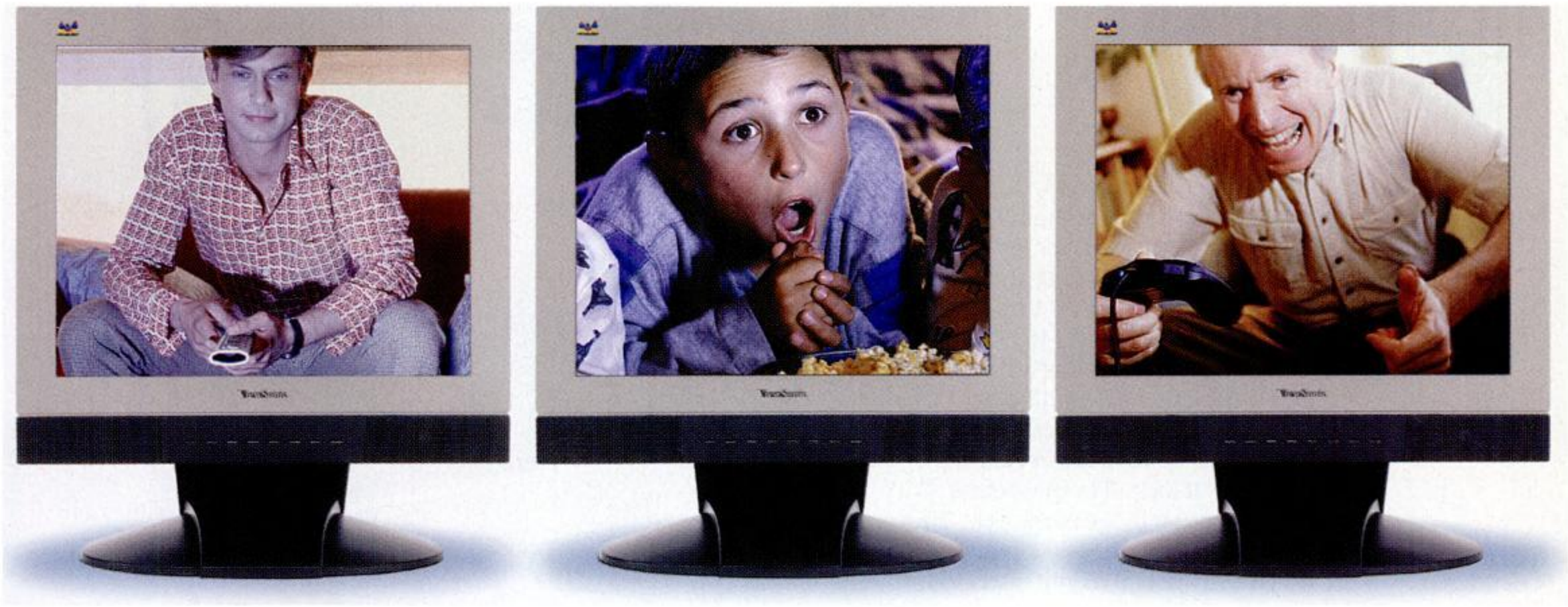
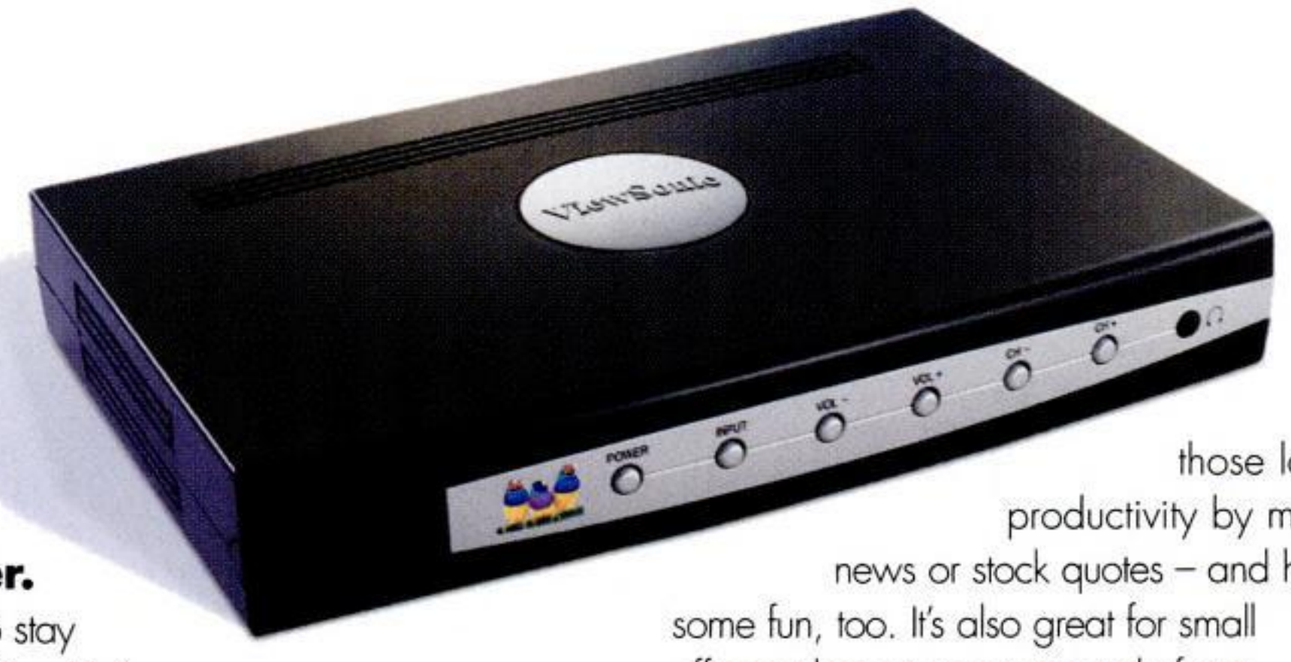
# Be all that you can be.



CHANNEL SURFER　　MOVIE GOER　　VIDEO GAMER

# Without ever leaving your desktop.



**NextVision™ N5 from ViewSonic.® It turns your display into a high-resolution TV, gaming and multi-media center.**

You multitask every day. To stay competitive, you have to. Shouldn't your computer monitor do the same? ViewSonic, the Visual Technologies™ leader, introduces a revolution in desktop productivity and convenience. The new NextVision N5 Video Processor transforms any CRT or LCD monitor into a powerful multi-media viewing center. Connect a cable feed or antenna and with the press of a button, switch from your computer application to full screen, ultra high resolution television viewing (up to 1024x768) via the built-in TV tuner. NextVision N5 also connects DVD players, VCRs and digital cameras. Even plug in your Xbox,® PlayStation2® or Nintendo® for a visual gaming experience like none you've seen before. Complete with 28-key remote control, NextVision N5 is the perfect desktop addition for those looking to maximize productivity by monitoring television news or stock quotes – and have some fun, too. It's also great for small offices where space is too tight for a separate computer display and television. Setting up NextVision N5 is as easy as a TV. No complicated cards or software to install. Use the included cable to connect the NextVision N5 directly to your monitor (you don't even need a PC). Turn an ordinary desktop into an extraordinary viewing experience. Visit ViewSonic.com today and See the Difference.®

*EZ Set-up with RGB in/out, S-Video input, Video Input, Stereo Audio inputs, audio line in and speaker out. Just plug and play.*

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*See the difference.®*

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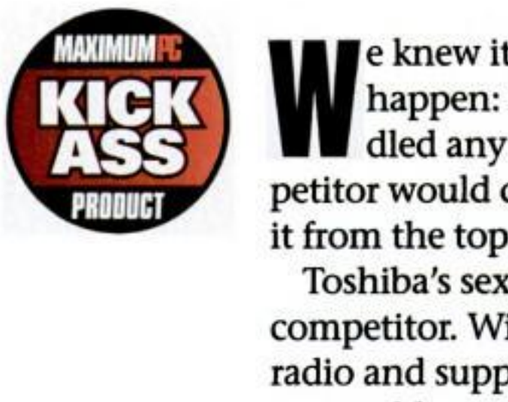
# Toshiba e740

## Pocket PC done right




We knew it was bound to happen: If Palm thumb-twiddled any longer, some competitor would come along and knock it from the top of the PDA hill.

Toshiba's sexy, thin e740 is that competitor. With a built-in Wi-Fi radio and support for multiple removable storage devices, the e740 doesn't just knock around Palm's hardware, it kicks it to the ground and stomps on it, Joe Pesci–style. The e740 is similar to the e550 (which sold mostly in Japan), but offers some key improvements.

The first improvement is the slot for Compact Flash Type II cards. On the original Toshiba Pocket PC, the flap cover wasn't removable, so it proved cumbersome whenever you plugged in a device that extruded beyond the PDA's surface. (When we asked a Toshiba rep about this predicament, we were advised to cut off the flap!) In the new e740, the CF slot is open, so you can run a modem or LAN card unobstructed. The e740 also features an easily replaced battery that slides right out when it's finally reached its limit. (Most Pocket PCs, such as the original e550, use internal batteries that can't be easily replaced.) Toshiba also plans to offer an extended-life battery pack that replaces the stock battery.

But the e740's most amazing feature is its built-in Wi-Fi support. Some people may argue that Bluetooth would be more useful, but let's face it, Bluetooth is going nowhere. Regardless, Bluetooth support can always be added through the unit's SecureDigital I/O slot. Thanks to the e740's Wi-Fi support, you can cruise the Internet while running a 1GB IBM MicroDrive (or whatever else you want) in the device's CF Type II slot. Sure, you can run MicroDrives on other PDAs, but not without bulky adapter sleeves. Browsing the Internet with a PDA version of *Internet Explorer* and a tiny, vertical screen isn't the most satisfying experience, but it's better than what you'll get from any so-called smart phone. Toshiba also includes an expansion port that adds USB and VGA-out.

The e740's graphics are powered by ATI's Imageon 100 chip. It's a joke by desktop standards, but offers hardware-based MPEG4 decompression and 2D acceleration (PDA firsts, as far as we know). The chip even includes 384K of video RAM! Toshiba also plays the speed game with its CPU. Instead of using an Intel 206MHz StrongARM processor, the e740 packs the new Intel PXA250 chip, which hums along at 400MHz.

Unfortunately, all this silicon doesn't translate into immediately tangible performance. Since most Pocket PC 2002 apps are optimized for the StrongARM platform, few can take advantage of the e740's extra megahertz. Some apps actually perform worse on the e740, and one vendor told us that part of the problem lies within the Microsoft OS. Fortunately, many developers seem happy to embrace the new graphics chip and Intel processor, so we're confident that popular Pocket PC 2002 apps will be upgraded accordingly.

Negatives? Well, we'd like to see a backup battery. Should Toshiba's battery die or pop out by accident, your data is a goner. There are also a few sharp edges near the stylus that should be ground down; on a few occasions, we almost tore the top off the PDA when removing the stylus. Finally, the software bundle is slim compared to other Pocket PC bundles. But these are all just little snags in one of the niftiest PDAs on the market. The Toshiba e740 is sexy enough to inspire second thoughts in even the staunchest of Palm holdouts.

**—GORDON MAH UNG**

**Toshiba's e740 should make even Palm holdouts envious—it's just that jam-packed with goodness.**

### THE SPECS

| | |
|---|---|
| **Screen** | 240x320@16-bit |
| **Viewable image** | 2 1/8 x 2 3/4 |
| **OS** | Pocket PC 2002 |
| **CPU** | 400MHz Intel PXA250 |
| **Graphics** | ATI Imageon 384K |
| **RAM** | 64MB |
| **Expansion** | Compact Flash II, SecureDigital |
| **Bundle** | Pocket PC 2002, Adobe *Acrobat Reader* |

**The e740 supports both Compact Flash Type II cards and SecureDigital cards.**

**MAXIMUMPC VERDICT**

***e740***
TOSHIBA

**+ THIN & SEXY**
Built-in Wi-Fi makes the e740 the perfect platform to browse the web while sitting on the throne.

**– FAT & LUMPY**
No backup battery, and a skimpy software bundle.

**www.toshiba.com**
**$600**
**9**



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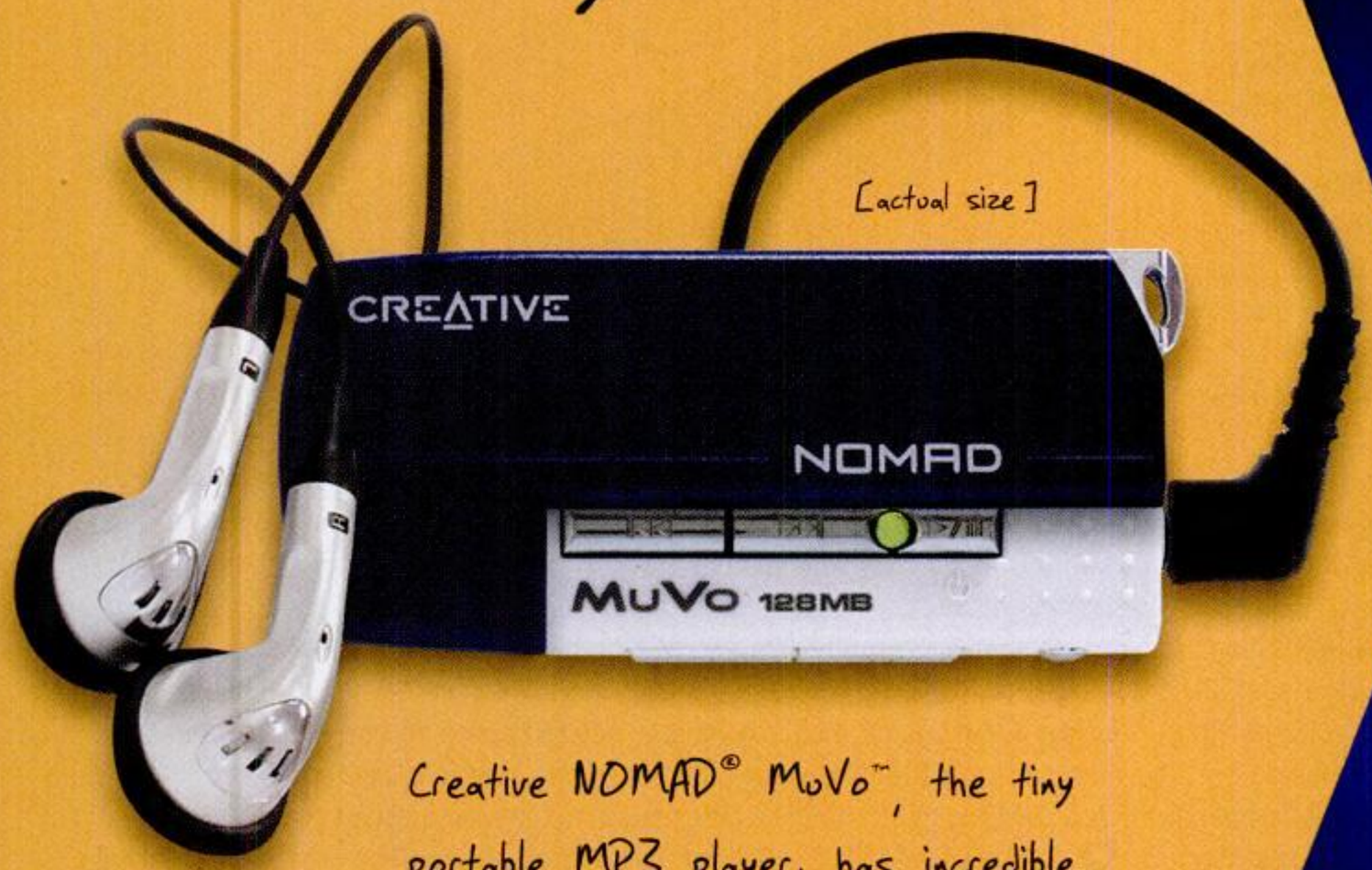
CREATIVE

# NOMAD®

## MuVo™

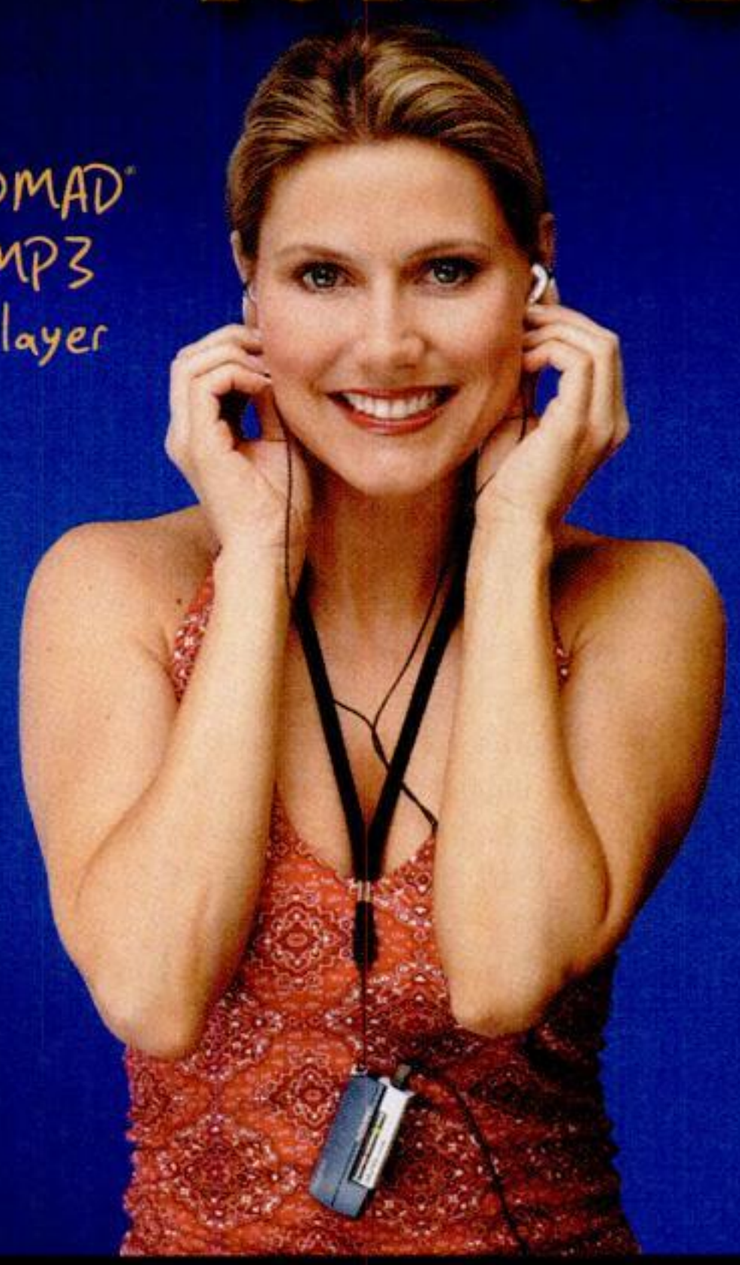
"MuVo" your music...

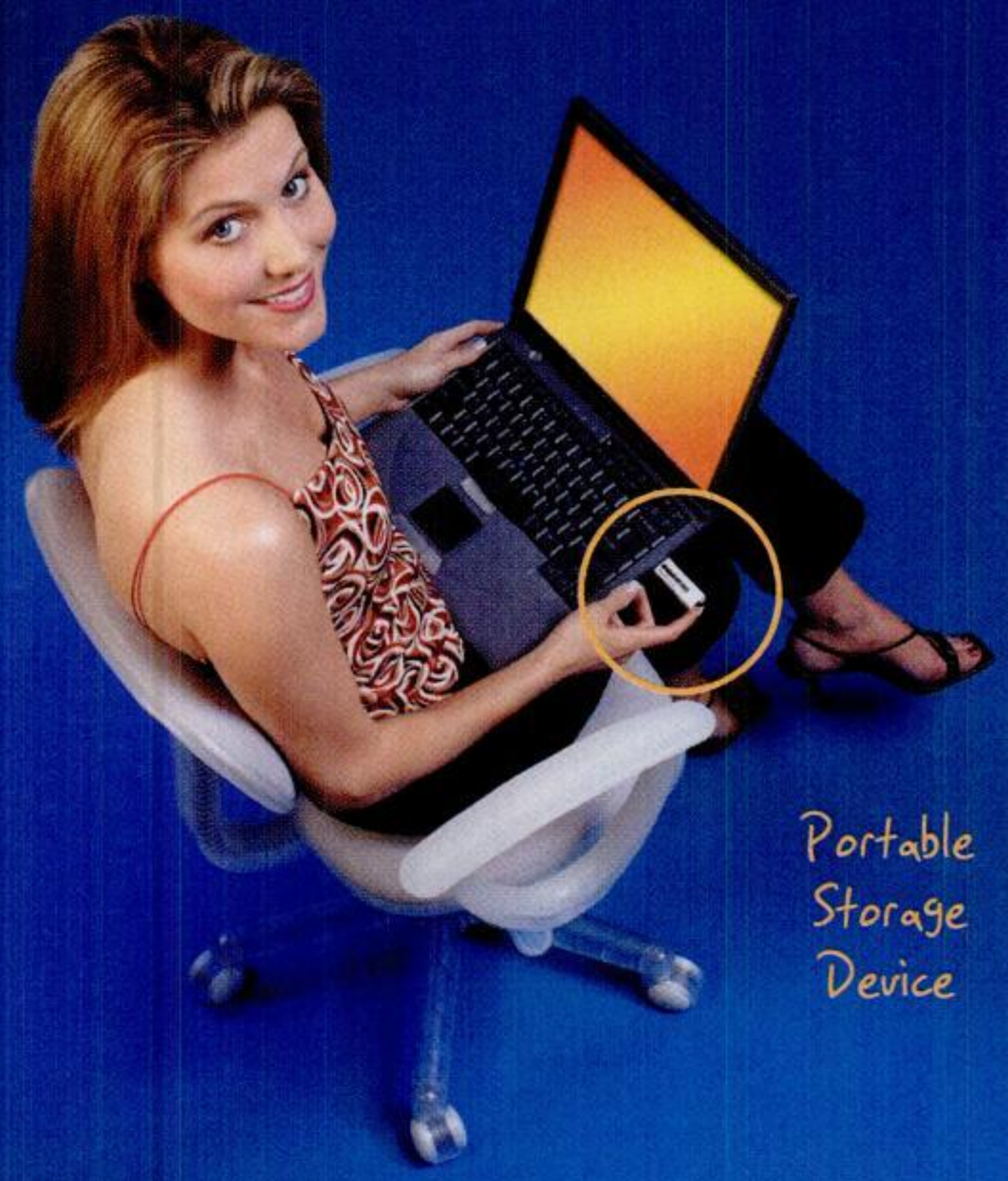
[actual size]




Creative NOMAD® MuVo™, the tiny portable MP3 player, has incredible sound quality and great battery life.

NOMAD® MP3 Player





Portable Storage Device

"MuVo" your files...

The 128MB MuVo Memory™ plugs directly into your PC's USB port so you can drag and drop up to 88 floppies of documents, presentations, and your favorite music files.

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Visit **www.nomadworld.com**

CREATIVE®

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# Iomega Zip 750MB

## Portable storage from beyond the grave

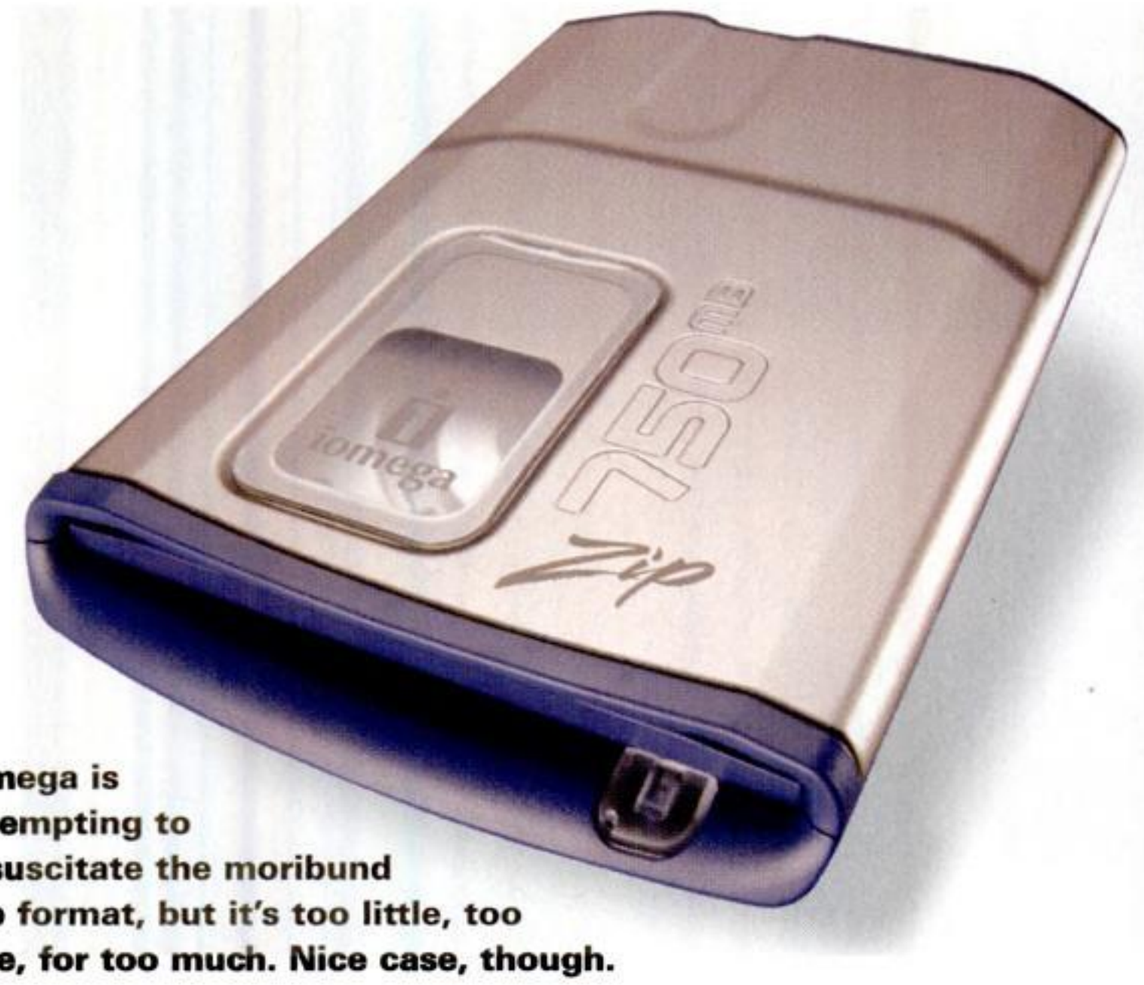
Back in the day, you *had* to have a 100MB Zip drive. Sure, the media was overpriced, but once the format took off and Zip drives became ubiquitous, well, that was that. We needed more portable storage than floppy disks could provide, and Zip was worth the money. But times have changed. At $180, Iomega's new USB 2.0 750MB Zip drive is twice the price of faster and more format-friendly optical drives.

The external Zip 750MB will read from 100MB, 250MB, and 750MB Zip disks, but will write to only 250MB and 750MB Zip disks. This sucks, because every Iomega supporter whom *we* know is heavily invested in 100MB Zip disks and would probably like to write to that format. Perhaps even worse, the 750MB disks can't be read by older Zip drives.

The box proudly states that the drive writes, rewrites, and reads at 50x—but we want to know, 50 times what? Because of the way the box copy is presented (see below), one would assume that Iomega is comparing its drive's speed to that of optical drives (where 1x equals 150Kbps). But we don't see any explicit statements on the box saying so. Even stranger, the "50x" ratings are asterisked, but the corresponding notation makes no reference to performance, let alone how Zip performance might relate to CD-RW performance.

Regardless, the Zip 750MB doesn't perform nearly as well as the best CD-RW drives. The best time we were able to achieve filling an entire 750MB disk was 4:58 (we transferred a mixture of small and large files to the drive from our C: partition). For comparison, Lite-On's 48x burner writes 647MB to a CD-R in just 2:35.

We must also note that 4:58 was the *best* transfer time we were able to get from the Zip 750MB. When we tried to transfer the same files from a different partition, our time bloated to 13:19. We got the same wide performance margin regardless of whether we used an Adaptec USB 2.0 card or an Orange Micro USB 2.0 card. Please note: No USB 2.0 card is included with the drive. In fact, the package doesn't even include a single Zip disk!




**Iomega is attempting to resuscitate the moribund Zip format, but it's too little, too late, for too much. Nice case, though.**

Iomega is currently charging $40 for three 750MB disks. You could buy more than 100 CD-Rs or 70 CD-RWs for that price, all of which will be playable in just about any PC on Earth. Iomega seems to have forgotten that, other than legacy Zip 100MB drives, the Zip format is no longer a popular standard. The Zip 750MB suggests that it's not going to be one tomorrow, either.

⊕ **A FRUIT BASKET:** You may be able to apply the Iomega credit you received from the "Click of Death" class-action lawsuit toward this drive.

⊖ **ON GRANDMA'S CASKET**: Too expensive, not very fast, the disks can't be read in older Zip drives, it can't write to 100MB Zip disks… Shall we go on?

**—LOGAN DECKER**

**MAXIMUM PC VERDICT: 4**

$180, Iomega, www.iomega.com

---

# Ectaco Partner UT-203 Universal Translator

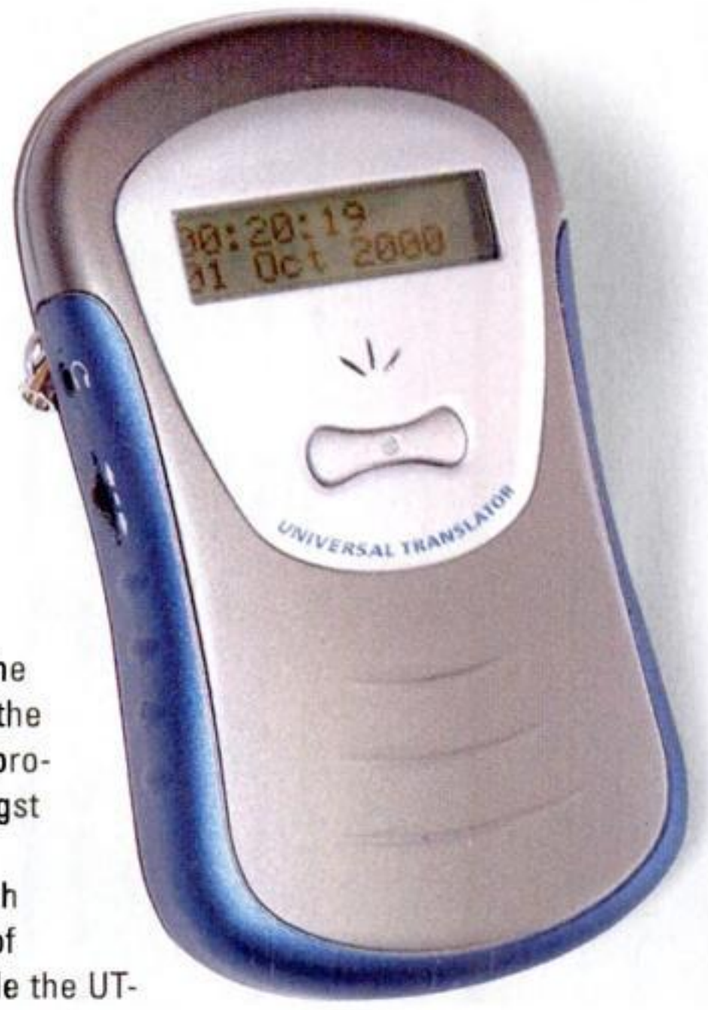
## A giant step backward for international relations

Thdj eidkke pdlkjdiewpsh!" No, that's not Dutch. It's the wacky *lingua fracas* of the Ectaco UT-203 Universal Translator, a "speech-to-speech" translator that fits in the palm of your hand. Speak into the UT-203, and the translator searches for the closest match in its common-phrase database of 3,000 entries. The phrase is then played from a digitized voice recording in English, Russian, or German.

Not surprisingly, the problem isn't with the translations—it's with the speech recognition. Speak into the mic (in the center of the UT-203, or via the included headset), and the UT blurts out its best guess. Strangely, even a simple "hello" became "Calm down. Everything is OK."

Thankfully, you can turn off the automatic translation function and scroll through phrases manually. The speech recognition becomes far more accurate when you narrow the translation to specific topics like "Hotel" or "Shopping." But even when the UT-203 gets it right, the sound quality of the rough, severely clipped recordings is akin to that of an old Speak 'n Spell.

The model we tested translates from English into Russian and German, and from Russian into German or English. Hearing phrases translated into English gave us a good idea of what we'd be putting other people through—the grainy recordings took several listenings to comprehend. In fact, it was quite a while before we even realized that the English was being spoken with a British accent. Uh-oh.




**Don't American tourists have a bad enough rap already? We don't need people running around thrusting this squealing box in the faces of horrified Europeans.**

We wanted to love it, but the UT-203 not only fails to bridge the language gap, it may actually promote suspicion and fear amongst peoples of different tongues.

⊕ **LATIN:** If they offer a French version, imagine the reaction of hyper-defensive Parisians while the UT-203 mangles their language—*Sacre bleu*!

⊖ **PIG LATIN**: Incompetent speech recognition ranks the UT-203 among the worst of SkyMall gadgetry.

**—LOGAN DECKER**

**MAXIMUM PC VERDICT: 3**

$250, Ectaco, www.ectaco.com



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## COMPONENTS

| | |
|---|---|
| Abit AT7MAX2 with AMD Athlon XP 2600+* | $419 |
| Abit KD7-RAID with AMD Athlon XP 2000+*** | $239 |
| Abit BD7II-533 with Pentium®-4 2.53GHz | $414 |
| Asus P4T533-R with Pentium®-4 2.53GHz | $469 |
| Asus P4B533-E with Pentium®-4 2.53GHz | $449 |
| Asus A7V8X with AMD Athlon XP 2600+* | $412 |
| Asus A7S333 with AMD Athlon XP 2000+*** | $186 |
| Gigabyte GA-7VAXP with AMD Athlon XP 2600+* | $365 |
| Gigabyte GA-7VRX with AMD Athlon XP 2200+** | $214 |
| Gigabyte GA-7DPXDW w/AMD Athlon MP 2000+*** | $368 |
| Gigabyte GA-SR533 with Pentium®-4 2.0GHz | $267 |
| Gigabyte GA-8IGX with Pentium®-4 2.4GHz | $345 |
| Gigabyte GA-8IEXP with Pentium®-4 2.53GHz | $429 |
| Gigabyte GA-8IHXP with Pentium®-4 2.8GHz | $769 |

MOTHERBOARDS

**Gigabyte DPXDW-C with AMD Athlon MP2200+**

| | |
|---|---|
| 40GB 7200rpm Western Digital WD400BB | $72 |
| 80GB 7200rpm Western Digital 8MB Cache | $119 |
| 1200B 7200rpm Western Digital 8MB Cache | $189 |
| 40GB 7200rpm ATA/133 Maxtor D740X | $79 |
| 80GB 7200rpm ATA/133 Maxtor D740X | $109 |
| 160GB 7200rpm ATA/133 Maxtor D740X | $239 |
| 40GB 7200rpm IBM 120GXP | $73 |
| 80GB 7200rpm IBM 120GXP | $99 |
| 120GB 7200rpm IBM 120GXP | $139 |

HARD DRIVES

**IBM, 40GB, 7200rpm ATA/100**

| | |
|---|---|
| CDRW 24x10x40 TDK VeloCD IDE/ATAPI | $59 |
| CDRW 48x16x48 TDK VeloCD IDE/ATAPI | $95 |
| CDRW 24x10x40 TDK VeloCD External USB | $139 |
| CDRW 24x10x40 TDK VeloCD External FireWire | $179 |
| CDRW 48x12x48 LITE-ON, Beige Color, IDE | $78 |
| CDRW 48x12x48 LITE-ON, Black Color, IDE | $78 |
| DVD, Lite-on, 16x Black Color | $48 |
| CDRW/DVD 20x10x40x12 Plextor, Beige/Black,IDE | $199 |
| CDRW 48x24x48 Plextor, Beige/Black, IDE | $179 |
| CDRW 44x24x44 Yamaha, Beige/Black, IDE | $169 |
| DVD-RW Pioneer AO4 | $299 |
| DVD-RW HP 200XI | $399 |

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|---|---|
| Video,32MB ATI Rage-128, AGP | $35 |
| Video,64MB ATI Radeon-7000, AGP/PCI | $45/69 |
| Video,64MB ATI Radeon-9000, AGP | $69 |
| Video,128MB ATI Radeon-9000, AGP | $89 |
| Video,64MB Radeon-7500 All-in-Wonder, AGP | $119 |
| Video,64MB Radeon-8500DV All-in-Wonder, AGP | $249 |
| Video,128MB ATI Fire GL-8500, AGP | $329 |
| Video,128MB ATI Radeon-9700Pro, AGP | $319 |
| Video,64MB PNY GeForce4-TI4200,AGP | $169 |
| Video,128MB PNY GeForce4-TI4600,AGP | $269 |
| Video,128MB PNY Quadro4 750/900XGL, AGP | $599/1059 |
| SB Live! 5.1 Digital Sound Card | $35 |
| SB Live! Audigy Digital Sound Card | $65 |
| SB Live! Audigy Platinum | $169 |
| Turtle Beach Santa Cruz Digital Sound Card | $65 |

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**ATI Radeon-9700Pro**

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|---|---|
| Compucase CI-6919B Fire Wire/USB, 300W | $79 |
| Compucase CI-6A19 Fire Wire/USB 2.0, 300W | $59 |
| Enermax 710/710B/710BB 350W | $99 |
| Enermax CS-5190 Silver/Red/Black Color | $389 |
| Inwin IW-L545, USB2.0. 180W Flex ATX | $49 |
| Inwin J508, USB2.0, 300W | $79 |
| Inwin Q2000, 400W | $149 |
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| HEC 350W Dual Fan Power Supply | $39 |
| RaidMax 500W Aluminum Power Supply | $69 |

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**COMPUCASE CI-6A19 with USB2.0 and 1394 FireWire Ports**

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|---|---|
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| 17" XGA LCD Scanport GL-82IA, .26DP | $509 |
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## ADAMANT SYSTEMS

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- 1.44MB Floppy Drive
- 16x/48x DVD-ROM Drive
- 48x12x48x CD-RW Drive
- 128MB DDR Nvidia T14600 4x AGP Graphics
- Sound Blaster Audigy 5.1Digital Sound Card
- Deluxe case w/2USB Ports and 320W Power Supply
- 1 Year Parts and Labor Warranty

Upgrade options:

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|---|---|
| 1024MB PC3200 DDR RAM | add $189 |
| 120GB 7200RPM Hard Drive | add $59 |
| 5.2GB DVD-RW Drive | add $299 |
| 54x24x48 CD-RW Drive | add $179 |
| 128MB Matrox Parhelia Graphics | add $99 |
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| MS Windows-98/XP Home | add $99 |
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**AMD Athlon™XP 2200+ ..... $969**
**AMD Athlon™XP 2400+ ..... $999**

- AMD Athlon™XP 2200+ Processor with QuantiSpeed architecture**
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- Promise RAID/133 IDE Controller
- Dual 120GB 7200 Hard Drive
- 1.44MB Floppy Drive
- 5.2GB Pioneer AO4 DVD-RW Drive
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- SB Platinum Audigy 5.1 Digital Sound Card
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- LCD Front Panel and 500W Power Supply
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Upgrade options:

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|---|---|
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| 160GB 7200RPM Hard Drive | add $199 |
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| 128MB Nvidia Quadro-4 900XGLVideo | add $739 |
| 19".29 LCD Monitor | add $799 |
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- 512MB PC3200 Micron DDR Memory
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- 1.44MB Floppy Drive
- 48x12x48x CD-RW Drive
- 16x/48x DVD-ROM Drive
- 128MB DDR Nvidia TI4600 4x AGP Graphics
- Sound Blaster Audigy 5.1 Digital Sound Card
- 10/100 Intel Ethernet Lan Card
- Deluxe Aluminum Case w/1394 FireWire,USB
- 1 Year Parts and Labor Warranty

Upgrade options:

| | |
|---|---|
| 1024MB PC3200 DDR RAM | add $189 |
| 120 7200RPM Hard Drive | add $59 |
| 5.2GB DVD-RW Drive | add $299 |
| 54x24x48 CD-RW Drive | add $179 |
| 128MB Matrox Parhelia Graphics | add $99 |
| 17".26 LCD Monitor | add $499 |
| MS Windows-XP Professional | add $149 |
| Labtec Wireless Keyboard & Mouse Kit | add $69 |

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- Promise RAID/133 IDE Controller
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- Dual 120GB 7200RPM 6MB Cache Hard Drive
- 16x/48 DVD-ROM Drive
- 52x24x48 CD-RW Drive
- 128MB ATI Radeon-9700Pro 8x AGP Graphics
- SB Platinum Audigy Sound Card
- Deluxe Aluminum Case w/1394 FireWire,USB
- LCD Front Panel and 500W Power Supply
- 3 Years Parts and Labor Warranty

Upgrade options:

| | |
|---|---|
| 5.2GB DVD-RW Drive | add $299 |
| 128MB Nvidia Quadro-4 900XGL Video | add $739 |
| 19".29LCD Monitor | add $799 |
| MS Windows-XP Professional | add $149 |
| Red Hat Linux-7.3 | add $69 |
| Klipsh Promedia 5.1 THX | add $389 |

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***AMD Athlon XP 2000+QuantiSpeed architecture operates at 1.67GHz. ****AMD Athlon XP 1800+QuantiSpeed architecture operates at 1533MHz.

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# Optical Mouse Mayhem

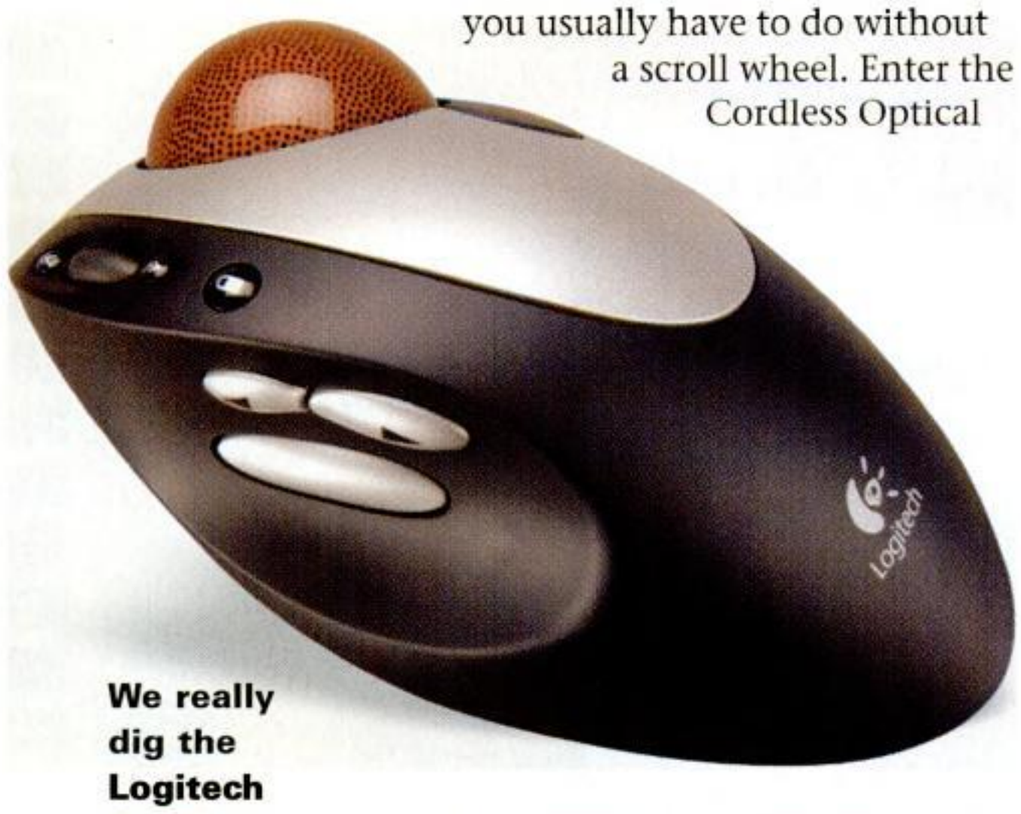
A bevy of mice without balls

If you think your old USB Intellimouse—you know, the one with the ball—is still state-of-the-art mousing, think again. It's time to upgrade to a next-generation optical mouse. At *Maximum PC*, we know exactly what we like to find in desktop rodentia: comfort, a good button layout, and responsiveness are necessary not only for regular desktop application work, but also hardcore gaming. So let's see how the latest competitors stack up!

—WILL SMITH

## Logitech Cordless Optical Trackman

Trackballs are just about worthless for gaming, but ergo-conscious people who work in desktop applications swear by them. Unfortunately, in order to use a trackball, you usually have to do without a scroll wheel. Enter the Cordless Optical Trackman, which comes with no fewer than eight buttons.



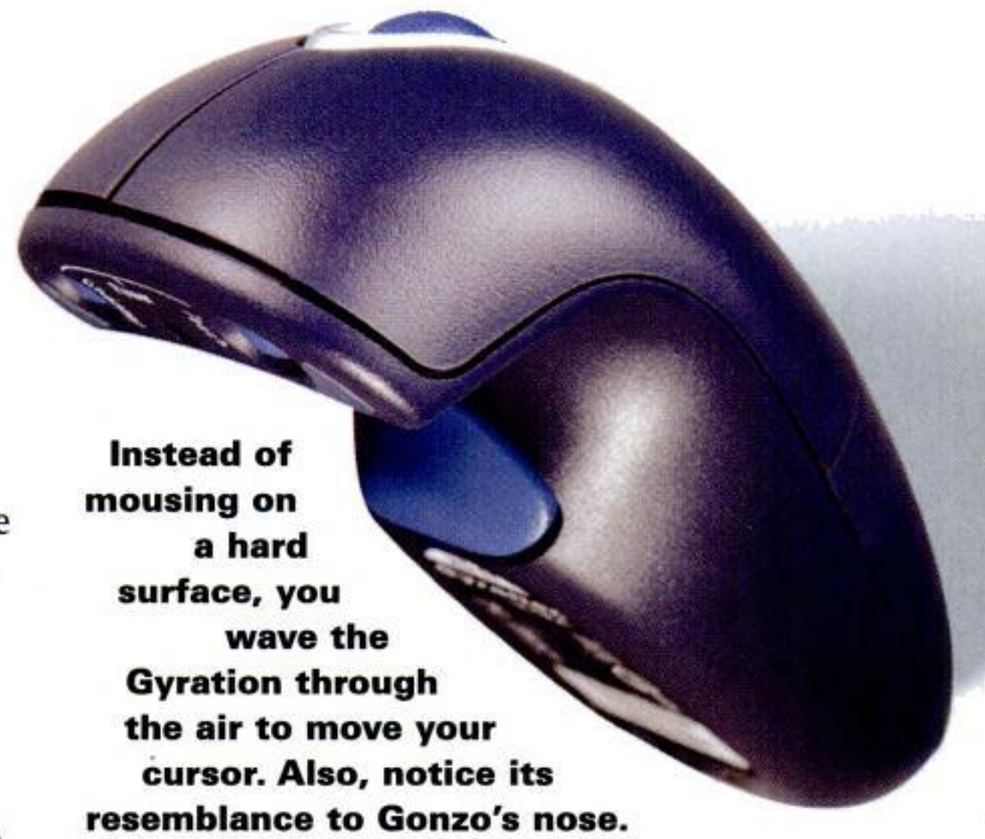
**We really dig the Logitech Cordless Optical Trackman, but we wouldn't give it to a friend to use for games. Unless, of course, he's going to be using it against us.**

Along with the standard two mouse buttons and wheel, the Cordless Optical Trackman includes forward and back buttons, and three proprietary Logitech buttons. By default, two of these special buttons operate a scrolling "cruise control" mode, and the third switches between active windows on your Desktop. The back and forth buttons are useful, but the other buttons are unnecessary and too small to be effective. The main buttons and the scroll wheel are comfortably arranged on the mouse's plastic and rubber surface, and are easy to hit while moving the cursor. The pair of AA batteries in the trackball give everything a good solid feel; this trackball won't slide around on your desk!

Control and accuracy are always a problem with trackballs, and wireless devices are notoriously inaccurate. As for the Cordless Optical Trackman, it updates accurately enough for desktop work, but is totally inappropriate for gaming. The slower update rate of the wireless interface combines with the inherent awkwardness of the trackball to spell sure death for an online fragger.

**MAXIMUM PC VERDICT: 8**

$70, Logitech, www.logitech.com



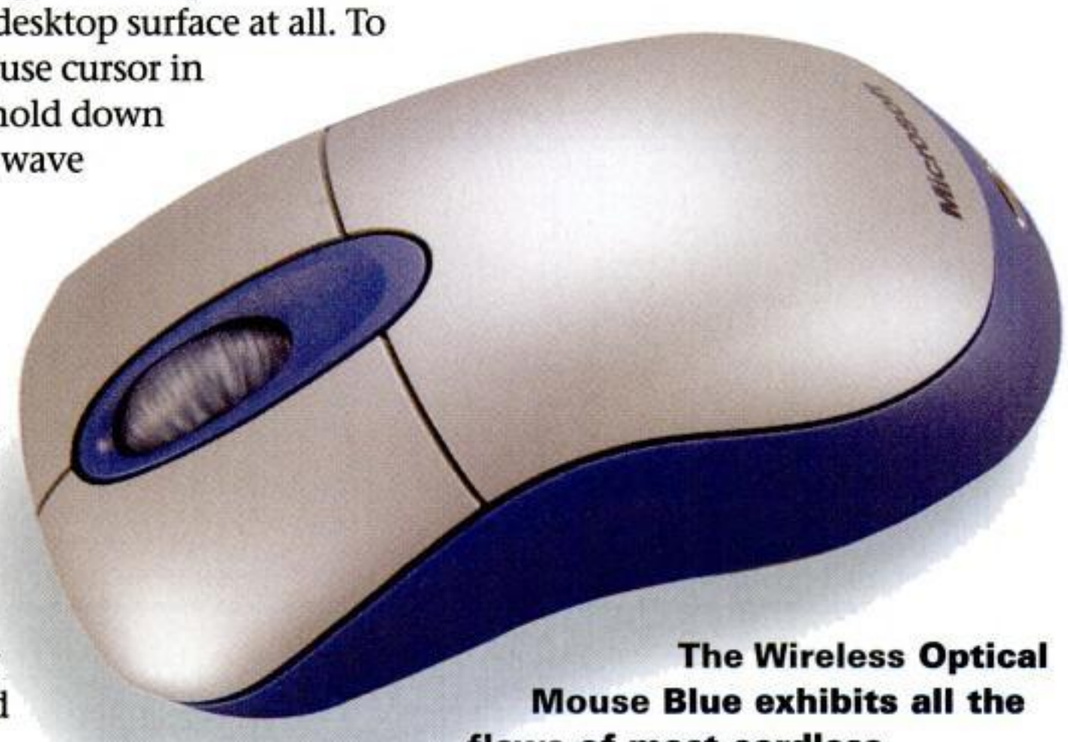
**Instead of mousing on a hard surface, you wave the Gyration through the air to move your cursor. Also, notice its resemblance to Gonzo's nose.**

## Gyration Ultra Cordless

The new Gyration Ultra Cordless pulls double duty as both a fancy-schmancy optical mouse and a trippy gyroscopic mouse you can use without any desktop surface at all. To move the mouse cursor in mid-air, just hold down a button and wave it back and forth like a wand. Not only does this evoke curious looks from passers-by, it's also a surprisingly effective way to move your cursor around the screen.

With a 40-foot range, the Gyration is perfect for use in living rooms (where it might anchor a home entertainment center) or in corporate conference rooms (where you can click through a *PowerPoint* presentation with aplomb). But the mouse doesn't work well for twitch games. The gyroscopes that detect movement are more than sensitive enough to work well for shooters, but unless you have hands steadier than a surgeon's, you won't have the control necessary for accurate kills. The device does, however, absolutely kick ass for RPGs and RTSes.

As a basic desktop optical mouse, the Ultra is run of the mill. It includes an easily flummoxed 800dpi sensor, similar to those of earlier optical mice. Still, you can't rely on the gyros forever, so at some point you'll need to get down and dirty on a flat surface. Bottom line: The Gyration costs just 80 bucks, and it's the best input device we've



**The Wireless Optical Mouse Blue exhibits all the flaws of most cordless products, and lacks any extra redeeming features.**



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ever tested for use in a home entertainment center PC.

**MAXIMUM PC VERDICT: 9**

$80, Gyration, www.gyration.com

## Microsoft Wireless Optical Mouse Blue

Wireless mice suck for gaming. You know it, we know it, the American people know it. This spiffy-looking new blue wireless optical mouse from Microsoft is no different. A poor wireless refresh rate and a sensor that easily loses track of its position conspire to make this mouse unacceptable for even the least discerning gamer.

Like every other wireless mouse we've tested, the Wireless Optical Mouse Blue feels stuttery when playing intense first-person shooters. Mouse movement isn't smooth, and simple tasks like aiming at a target and running in the proper direction become difficult. Of course, these flaws are only readily apparent in games. In desktop applications, this mouse is virtually indistinguishable from its corded brethren.

Previous versions of this mouse had dual buttons that were mapped to "Next Page" and "Previous Page" in your web browser. Unfortunately, they're now gone. On the plus side, this mouse is ambidextrous and fairly comfortable in the hand. It's not too small for mutant meat hands, and not too big for petite girly hands.

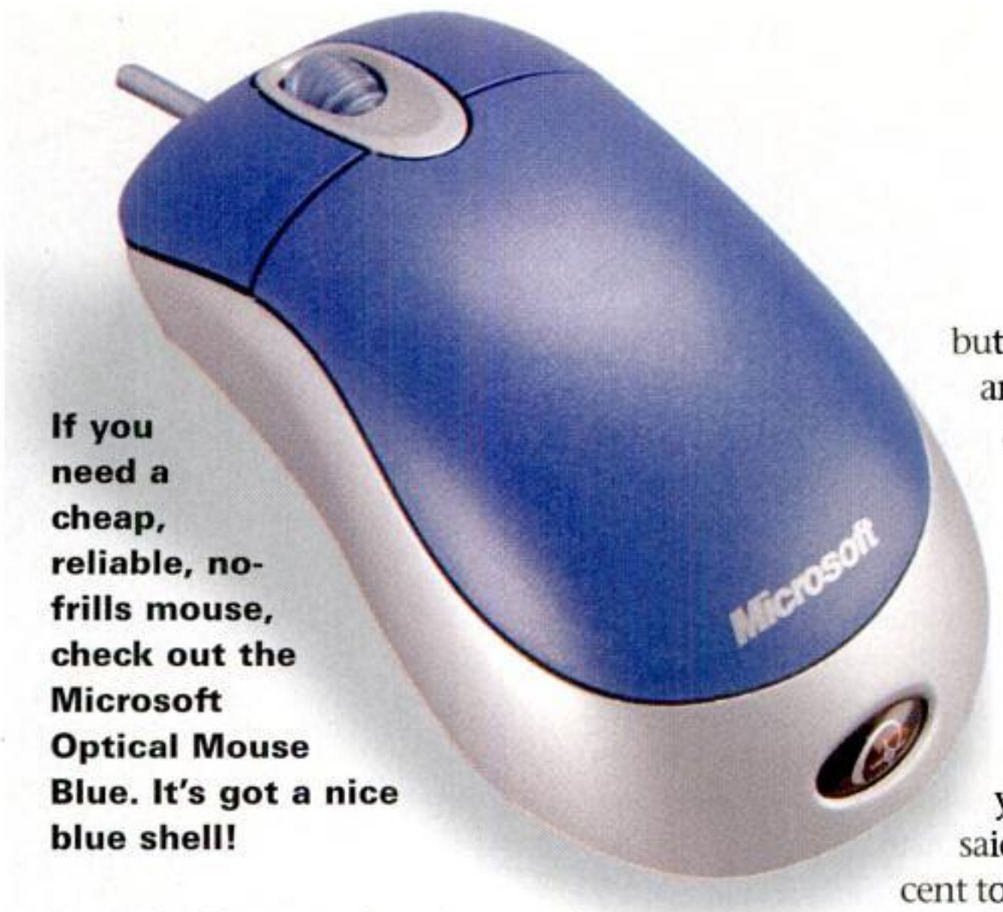
The Wireless Optical Mouse Blue is the cheapest wireless mouse we've ever seen. It's not suitable for gamers, but it does the job for day-to-day work.

**MAXIMUM PC VERDICT: 7**

$40, Microsoft, www.microsoft.com

## Microsoft Optical Mouse Blue

The new Blue is a standard two-button mouse with a scroll wheel that also serves as the third button. It all stacks up surprisingly well, especially for $35. Unlike most cheap optical mice, we weren't able to make the optical sensor on the Blue skip, even when we were moving the mouse as fast as we could. Response was prompt and consistent, even during intense deathmatches. Of course, you lose a lot of amenities with a budget mouse: There are no extra buttons or nifty software features. All you get is a reliable mouse suitable for gaming and desktop use.




**If you need a cheap, reliable, no-frills mouse, check out the Microsoft Optical Mouse Blue. It's got a nice blue shell!**

**MAXIMUM PC VERDICT: 8**

$35, Microsoft, www.microsoft.com

## Logitech MX700 Cordless Optical Mouse

MAXIMUM PC KICK ASS PRODUCT

Gaming. Cordless. Mouse. Three tastes that just don't go together. But fortunately for the gaming public, the folks at Logitech didn't get the memo about "New Standards in Cordless Mouse Ineptitude." Quite extraordinarily, the MX700 is actually *suitable* for gaming, despite its cordless handicap.

The MX700's main features are a high-resolution 800dpi sensor and a radio transmitter that sends updates at 125Hz, just like a normal wired USB mouse. During our extensive testing process, we weren't able to make the MX700 lose track of its position, even when we moved the mouse as fast as we were able to. Neither the refresh frequency nor the update rate seemed to slow down.

Like the Gyration Ultra, the MX700 includes rechargeable NiMH batteries and a recharging cradle. It took about an hour to charge to full, and that charge lasted for several days of normal mousing. Button layout on the MX700 is solid. The two main buttons and the wheel are easily accessible, and the two thumb buttons are simple to use. The Logitech also has three extra buttons that can be programmed to serve any function you'd like. All that said, we're a little reticent to wholeheartedly recommend a wireless mouse to gamers. But if you're looking for a new mouse and cordless is a requirement, the MX700 is really the only choice.

**MAXIMUM PC VERDICT: 9**

$80, Logitech, www.logitech.com

**Instead of two separate buttons, the Logitech MX700's left and right button are made of a single piece of metal.**



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# Cyberguys Nibbler

## Don't list your Dremel on E-Bay just yet

**We dare you to use this tool to carve Homer Simpson's face into your case.**

The Dremel MultiPro has long been the implement of choice for PC modders seeking to cut the side panels off their cases. While effective, a Dremel tool is expensive ($50 or more), and its blades often break while slicing through a metal computer case. This is why we were intrigued by the Nibbler's promise of making case cutting easy and affordable. All we had to do, claimed Cyberguys, was "just squeeze the handle."

Well, after testing the Nibbler in the Lab, we have to take issue with this dubious pretense. For one thing, we were under the impression that we would receive a stand-alone tool, but the Nibbler is essentially useless unless you make your first incision with a power drill and 3/8-inch drill bit. After scrambling a drill and gouging a sufficiently large hole in the side panel of our test case, we started carving. We initially entertained grandiose visions of chiseling Homer Simpson's visage into our case's side, but one look at the Nibbler's large cutting edge crushed these dreams. It's near impossible to use this tool to cut anything reasonably complex. Frankly, we'd gladly pay more for an adjustable cut size.

As far as its operation, the Nibbler is simple and straightforward. Just slide your target area into the small gap below the Nibbler's cutting edge, then squeeze the handles to punch out a sliver of metal. Unfortunately, only a small piece of metal comes off with each press of the handles. Consequently, making large cuts will push almost anyone's patience to the limit. Predictably, cutting through sheet metal requires a substantial amount of force, making the Nibbler painful to use for long periods of time. Its handles are too smooth to provide a solid grip, and the hard plastic finger-rests quickly instill soreness in even the most callused hands.

To its credit, however, the Nibbler has no problem making perfectly straight cuts. And for $8, you'd be hard-pressed to find a better product.

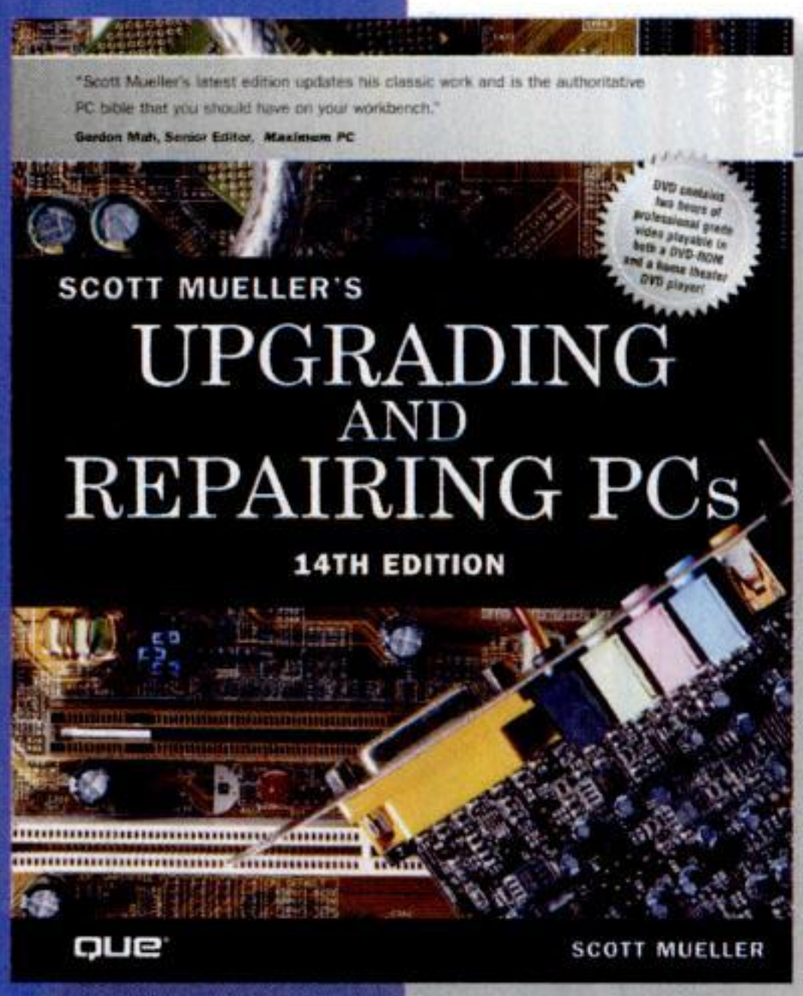
⊕ **BRAZIL'S 2002 WORLD CUP FINAL:** Cuts straight and costs less than lunch at the Imagine Media deli.

⊖ **BRAZIL'S 1998 WORLD CUP FINAL:** Slow and painful to use. Ill-suited for complex cuts.

**—OMEED CHANDRA**

**MAXIMUM PC VERDICT: 5**

$8, Cyberguys, www.cyberguys.com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# Olympus MIC-Digital Microscope

An ingenious digital camera that redefines the term 'lab testing'

The Olympus MIC-D is the love child of a low-end digital camera and a common classroom microscope—but the result is all high-end, through and through. Place anything on the microscope's stage and, *bam,* it shows up in realtime on your desktop. Not only can you watch single-celled life forms float lazily across your CRT, but the bundled software can do still-capture, time-lapse capture, and full video capture, too. Just imagine how useful all this multimedia will be for the kiddies' lab reports!

Within its sturdy metal body lies the eye of the MIC-D: a modest CMOS-based digital sensor. The sensor captures visuals at just 640x480, but at a respectable 255x maximum magnification thanks to a 9x optical zoom. At this level, we could see the individual cells of a lettuce leaf, as well as the faceted eye of an ant glaring coldly back at us.

The MIC-D's CMOS sits in the scope's base, and the light source shines down from above—a twist on traditional microscope design. The light source can also be pointed at different angles toward the specimen stage for a slew of innovative lighting options. For example, we could view amoebas blobbing around in a drop of water by using direct light, and examine the L1 bridges of an Athlon XP chip by using reflected light. Reflected light mode is doubly useful because the whole microscope can be flipped upside down and turned on objects that are too large or immobile to be placed on the stage itself (for example, your living room carpet or a brick wall). Across all the different lighting modes, image quality ranged from excellent in low- and mid-level magnifications, to merely OK in high-level magnifications. But don't worry: High-level magnifications did look great when we were using traditional slides and direct overhead lighting.

**The MIC-D software let us take stills and video clips of an ant flipping us the bird.**

In addition to its various capture options, the software provides thumbnail views of all your stills and videos. But the most thoughtful feature is the onscreen measurement scale (see screenshot). Yes, it measures in microns, but it needs to be manually adjusted to correctly correspond with the scope's actual magnification setting. Also useful is an automatic light exposure feature, which nicely compensates for diminished reflected lighting. Exposure can also be manually controlled.

Though we never felt the need to play with its image editing tools, the software does allow for rudimentary image tweaks. What we really appreciated was the software's stability—it didn't crash even once during Lab testing.

Amazing views of microcosms aside, the MIC-D has some flaws. For starters, our software required the entry of a four-digit serial number every time we started it up (let's hope future versions will drop this feature). Second, the LED light source provided enough illumination in most situations, but when we tried to view darker objects under maximum magnification, they reflected too little light for a decent image. And while the scope's documentation was complete, we didn't like the fact that it was only software-based and didn't include any sort of quick-start tutorial. We also would've appreciated some starter slides. Nonetheless, most of the MIC-D's flaws are forgivable given the functionality and stability of the whole package.

**Razor sharp optics, durable metal body, and a zoom control. What more could you ask for in a digital microscope?**

Without question, the MIC-D is poised to revolutionize classroom science. Kids will no longer have to deal with pimply-faced lab partners greasing up their optics, and they'll be able to infuse their lab reports with photographic evidence. Bottom line: Good classroom microscopes cost just as much as the MIC-D and don't provide nearly the breadth of features.

**—BRIAN LAM**

**MAXIMUMPC VERDICT**

***MIC-Digital Microscope***
OLYMPUS

**+ ANTS UNDER A MAGNIFYING GLASS**
Clear and high-powered magnifications right to your desktop. Full-featured capture ability.

**– LOOKING DIRECTLY AT A SOLAR ECLIPSE**
Annoying serial-number request every time the software starts. Lack of accessories and instructions.

**www.olympusamerica.com**
**$1300**
**9**


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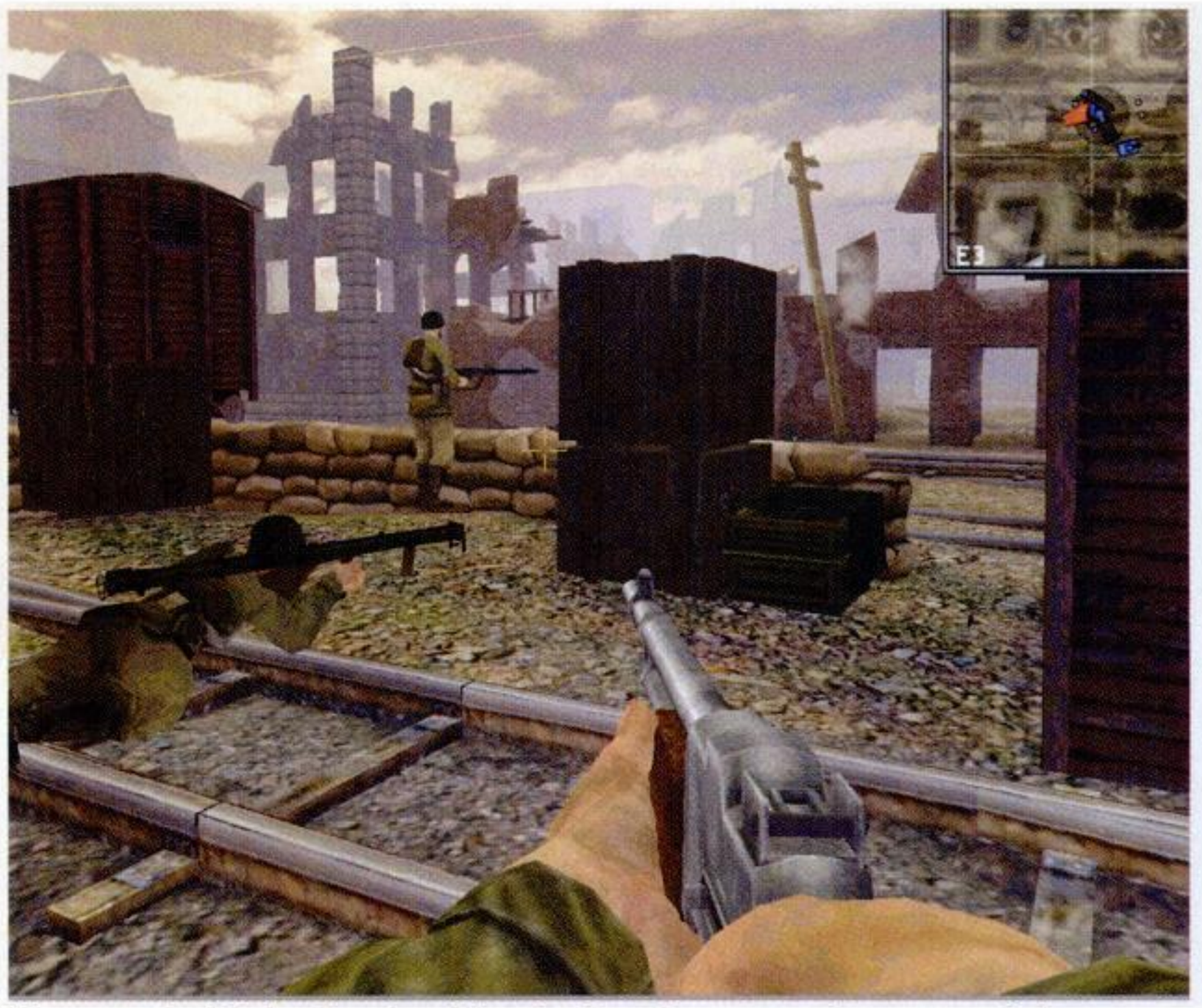
# Battlefield 1942

The sweet spot between sim and shooter, World War II–style



**We must hold the Fascists! In the Russian campaign, one of the missions challenges you to defend Stalingrad from the Nazi war machine.**

MAXIMUM PC KICK ASS PRODUCT

It's been a great year for WWII action aficionados. From *Return to Castle Wolfenstein* to *Medal of Honor: Allied Assault*, gamers have had plenty of opportunity to pretend they're Private Ryan. For the most part, however, these two stellar titles had us going solo. Enter *Battlefield 1942*, a fantastic WWII shooter that's best enjoyed playing online in teams.

The story behind the game? Well, there isn't one, other than, "Hey, it's World War II, and you're in the middle of it, soldier!" A set of 16 maps—all taken from famous conflicts such as Omaha Beach, Iwo Jima, and Stalingrad—are available for practice. You battle through the maps in no particular order, and your only goal is to hone your skills. Historical accuracy is chucked out the door, as players participate in a small-scale D-Day... in 1942. You can also progress through each of the scenarios from either side of the conflict (Axis or Allied) to better understand the flow of the maps.

**In *Battlefield 1942*, you'll take control of everything from Japanese fighters, to American PT boats, to this Russian T34/76.**

*Battlefield 1942's* control scheme will be immediately familiar to anyone who's played a team-based first-person shooter. It offers a *Tribes*-like communication system, with strategic commands. Your basic loadout consists of an automatic rifle, a pistol, three grenades, and a completely useless knife. Along the way you can acquire sniper rifles, bazookas, and other forms of hand-held destruction. From there, the game offers a slew of transportation options—everything from Jeeps and Tiger tanks to Zeroes, Corsairs, and Spitfires. On foot, in a half-track, or on the wing, the controls are consistent, and the handling characteristics, while not entirely accurate, do serve to differentiate each vehicle. For example, the fighters are skittish enough that you'll want to keep your finger above the "eject" key if you're a novice pilot.

Gameplay is a blend of Capture the Flag and Conquest/Assault. You initially spawn in your own base, then begin picking off control points that lie between you and the enemy. Eliminate the enemies from around a control point, sit by the flagpole for a couple of seconds, and you claim the area to use as a spawn point. It's an interesting way to mark territory as you advance, and because you spawn closer and closer to the front, capturing and holding control points becomes the focus of the game.

The bot-dependent single-player game is geared entirely towards multiplayer training (in fact, there isn't even a tutorial). We have mixed feelings about the bots' AI. They'll "accidentally" kill you with grenades, drop bombs on you, shoot you in the back, and nab every vehicle before you spawn. On the bright side, they're smart enough to drive to logical places, they'll take gunner duty in tanks, and they're cannily aggressive. A 60 percent or higher difficulty setting will prepare novice players quite well for online play.

Visually, the game depicts the European and Pacific theatres with aplomb. Textures are crisp and detailed, architecture is to scale and convincing, and the modeling is superb (especially the tanks and aircraft). The game's engine doesn't demand a beast of a machine, either. Our 1.3GHz Athlon with 512MB of memory and a 64MB GeForce3 Ti 500 card was peppy and smooth until we cranked everything to 1600x1200x32 with detail settings maxed.

When push comes to shove, *Battlefield 1942* is nothing revolutionary, nothing we haven't seen before elsewhere. But it's all wrapped up in an irresistible package that we've been playing till the wee hours. Without a doubt, it's become the most often played game in the Maximum PC Lab, so that should tell you something.

**—BILL MCCLENDON**

**MAXIMUM PC VERDICT**

***Battlefield 1942***
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**– FIRE IN THE HOLE!**
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**www.battlefield1942.com**
**$50**
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| Athlon XP 2600+ | CALL |
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| Athlon XP 2100+ | $97 |
| Athlon XP 2000+ | $82 |
| Athlon XP 1900+ | $73 |
| Athlon XP 1800+ | $69 |
| Athlon XP 1700+ | $63 |
| **ATHLON CLASSIC** | |
| Athlon 1.4 GHz | $83 |
| Athlon 1.33GHz | $53 |
| **ATHLON MP** | |
| Athlon MP 2100+ | $249 |
| Athlon MP 2000+ | $166 |
| Athlon MP 1900+ | $155 |
| **AMD DURON** | |
| Duron 1.3 GHz | $38 |
| Duron 1.2 GHz | $37 |
| Duron 1.1GHz | $36 |
| Duron 1.0GHz | $35 |

### INTEL PROCESSORS

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|---|---|
| **PENTIUM 4** | |
| 2.66 GHz 533FSB 512K | $412 |
| 2.53 GHz 533FSB 512K | $247 |
| 2.4B GHz 533FSB 512K | $198 |
| 2.26 GHz 533FSB 512K | $198 |
| 2.0 GHz 400FSB 512K | $165 |
| 1.8A GHz 400FSB 512K | $146 |
| 1.6A GHz 400FSB 512K | $166 |
| **PENTIUM III FCPGA/2** | |
| P-III 1.4 GHz 512k | $302 |
| P-III 1.2 GHz 256k | $114 |
| P-III 1.13 GHz 256k | $109 |
| P-III 1.0 GHz 256k | $125 |
| **CELERON FCPGA2/478** | |
| Celeron 1.8GHz s478 | $82 |
| Celeron 1.7GHz s478 | $72 |
| Celeron 1.3GHz s370 | $66 |

### COOLING ACCESSORIES

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|---|---|
| **COOLERMASTER** | |
| **SocketA & 370** | |
| SuperCool Aluminum | $8 |
| AMD Appvd Aluminum | $8 |
| Jumbo Aluminum Fan | $9 |
| HCC 7k RPM Pure Cu | $25 |
| HHC 7k RPM Cu Pipe | $34 |
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| **THERMALTAKE** | |
| Volcano5 AMD App | $10 |
| Volcano6cu+ Copper 7K | $13 |
| Volcano7 SocktA | $22 |
| Volcano7+SktA/478 CU | $40 |
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| Active Mem Cooling Kit | $16 |

### USB

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|---|---|
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| USB 2.0 4port PCI Card | $23 |
| USB 2.0 4port HUB | $35 |
| USB 2.0 EXT ENCL | $79 |
| USB 2.0 A-to-B cable 6ft | $4 |

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| 81GB 100/7200/2MB | $120 |
| 120GB 100/5400/2MB | $154 |
| 160GB 133/5400/2MB | $298 |
| **WESTERN DIGITAL** | |
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| 60GB 100/7200/2MB | $97 |
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| 100GB 100/7200/2MB | $138 |
| 100GB 100/7200/8MB | $139 |
| 120GB 100/7200/2MB | $177 |
| 120GB 100/7200/8MB | $191 |
| **IBM** | |
| 40GB 100/7200/2MB | $79 |
| 60GB 100/7200/2MB | $96 |
| 80GB 100/7200/2MB | $110 |
| 120GB 100/7200/2MB | $147 |
| **IOMEGA** | |
| 250MB Internal | $69 |
| 250MB EXT USB | $133 |
| 250MB EXT PAR | $138 |

### CONTROLLERS

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|---|---|
| TCW PCI ATA133 | $26 |
| TCW PCI ATA133 RAID | $36 |
| **PROMISE** | |
| PCI ATA133 | $35 |
| PCI ATA133 RAID | $94 |

### DRIVE COOLING

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|---|---|
| PCI Slot System | $7 |
| 3.5" SGL FAN HDD | $11 |
| 5.25" DUAL FAN HDD | $19 |
| Coolermaster Alum HDD | $29 |

### CASES

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|---|---|
| Midtower 350w Black | $68 |
| Enlight Mid 7237 USB | $66 |
| FullTower 300w | $54 |
| Aluminum w/Window | $189 |
| Blk Aluminum w/Window | $189 |
| **ANTEC** | |
| KS282 300W MID Beige | $59 |
| PLUS660AMG 330W Mini | $103 |
| SX630II 300W Mini-Tower | $72 |
| SX1040BII 400W File Server | $95 |
| **COOLERMASTER-** Aluminum | |
| ATC-101-SX4 w/o PS | $235 |
| ATC-110-SX1 w/o PS | $264 |
| ATC-201-SX w/o PS | $172 |
| ATC-210-VX1 w/o PS | $211 |
| **CASE ACCESSORIES** | |
| 80MM fan guard | $3 |
| 6pk Case thumbscrews | $4 |
| Blue Neon Cathode | $25 |
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### VIDEO CARDS

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|---|---|
| **POWERCOLOR-NVIDIA** | |
| Geforce2 MX400 64MB | $49 |
| GeForce4 Ti4200 128MB | $173 |
| GeForce4 Ti4600 128MB | $359 |
| **Powercolor - ATI Powered RADEON** | |
| 9000 64mb DDR | $86 |
| 9000 Pro 64mb DDR | $122 |
| 9000 Pro 128mb DDR | $129 |
| 9700 Pro 128mb DDR | $339 |
| **MSI** | |
| TV Anywhere | $56 |
| GeForce 4 Ti 4200 | $181 |
| GeForce 4 Ti 4600 | $275 |
| **ATI - Built by ATI** | |
| AIW 7500 64MB | $175 |
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| **MATROX** | |
| Millennium G550 32MB | $96 |
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| **Powercolor - SiS Powered** | |
| Revenger SiS315 128MB | $59 |
| SiS Xabre400 8X 128MB | $109 |

### CD ROMS

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|---|---|
| 54X Mitsumi | $26 |
| 52X Asus | $28 |
| 52X Creative Labs | $28 |
| 52X Lite-On | $24 |

### DVD ROMS

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|---|---|
| 16X Samsung | $42 |
| 16X Toshiba | $42 |
| 16X Lite-On | $32 |
| 16X Lite-On Black | $49 |

### CD-RW

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|---|---|
| 16x10x40x12 Toshiba w/DVD | $112 |
| 32/12/40 Mitsumi BLK | $70 |
| 40/12/48 Teac | $83 |
| 40/12/48 Lite-On | $60 |
| 40/12/48 Lite-On BLK | $60 |
| 48/12/48 Lite-On | $74 |
| 48x16x48 MSI Retail | $77 |

### DVD R/RW

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|---|---|
| **PIONEER** | |
| DVR-A04 | $339 |
| DVD R Media 5 Pack | $25 |

### MEMORY

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|---|---|
| **DDR** | |
| 256MB PC2100 | $65 |
| 512MB PC2100 | $127 |
| 256MB PC2100 REG | $84 |
| 512MB PC2100 REG | $155 |
| 1.0GB PC2100 REG | $376 |
| 256MB PC**2700** | $69 |
| 512MB PC**2700** | $135 |
| **SDRAM** | |
| 64MB PC100 | $16 |
| 128MB PC100 | $22 |
| 256MB PC100 | $39 |
| 64MB PC133 | $16 |
| 128MB PC133 | $22 |
| 256MB PC133 | $43 |
| 512MB PC133 | $59 |
| 256MB REG NON-ECC | $53 |
| 256MB REG ECC | $57 |
| 512MB REG NON-ECC | $47 |
| 512MB REG ECC | $87 |
| **RAMBUS** | |
| 128MB PC800 NON-ECC | $53 |
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| 128MB PC800 ECC | $55 |
| 256MB PC800 ECC | $107 |
| 512MB PC800 ECC | $298 |

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| **MICROSOFT** | |
| Intellimouse Optical | $24 |
| Natural Keyboard | $23 |
| Office Keyboard | $28 |
| **LOGITECH** | |
| Cordless Optical Mse/KB | $79 |

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| CREATIVE LABS | |
| Audigy 5.1 | $65 |
| Audigy MP3 5.1 | $81 |
| Audigy X-Gamer 5.1 | $87 |
| Audigy Platinum | $175 |
| Extigy | $140 |

### MOTHERBOARDS

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|---|---|
| ***GIGABYTE*** | |
| GA-8IE i845E 533FSB DDR | $95 |
| GA-8IEXP i845E 533F DDR | $139 |
| GA-8IHXP i850E 533F RDR | $171 |
| ***SOYO*** | |
| P4SY645DX DRAG. DDR | $158 |
| ***ASUS*** | |
| P4B533 i845E 533FSB DDR | $134 |
| P4B533E i845E 533FS DDR | $165 |
| ***MICROSTAR*** | |
| MSI 845E MAX2-BLR | $163 |
| MSI 845E MAX2-LR | $130 |
| MSI 845G MAX-L | $100 |

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|---|---|
| ***GIGABYTE*** | |
| GA-VAX KT333 DDR | $80 |
| GA-VAXP KT333 DDR | $106 |
| ***GIGABYTE DUAL SCKTA*** | |
| GA-7DPXDW A760MPX | $261 |
| ***MICROSTAR*** | |
| MSI KT4 ULTRA SR | $108 |
| MSI KT4 ULTRA | $102 |
| MSI KT3 ULTRA2-BR | $130 |
| MSI KT3 ULTRA2-R | $104 |
| MSI KT3 ULTRA2 | $82 |
| ***MICROSTAR DUAL SCKTA*** | |
| K7D MASTER A760MPX | $211 |
| ***SOYO DRAGON*** | |
| ULTRA BLACK | $155 |
| LITE KT266A DDR | $87 |
| PLATINUM | $176 |
| ***ASUS*** | |
| A7S333 SiS DDR | $70 |
| A7V333R KT333 DDR | $142 |
| A7N266E N420D DDR | $166 |
| ***ASUS DUAL SCKTA*** | |
| A7M266D A760MPX | $231 |

### NETWORKING

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|---|---|
| **SWITCHES/HUBS** | |
| 8port 10Mb | $19 |
| 8port 10/100 Switch | $28 |
| 16port 10/100 Switch | $79 |
| Linksys Cable/DSL Rout. | $76 |
| **NETWORK ADAPTERS** | |
| TCW Realtek | $9 |
| 3Com | $32 |
| Intel Pro 100/s | $32 |
| Intel Pro/1000MT | $48 |

### WIRELESS NETWORKING

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| **LINKSYS** | |
| WIFI USB LAN Adapter | $154 |
| PCMCIA WIFI Adapter v2.5 | $109 |
| PCI WIFI Adapter | $43 |
| WIFI PCMCIA -> PCI ADAP | $90 |
| WIFI Access Point | $69 |
| Cable/DSL Router | $71 |

### MONITORS

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|---|---|
| **17"** | |
| AOC 7ELR .23hdp | $149 |
| AOC 7F .21hdp Flat | $158 |
| AOC 7E-BLK .23hdp | $156 |
| AOC 7F-SLK .23hdp | $179 |
| **19"** | |
| AOC 9GLR .21 mdp | $200 |
| AOC 9KLR .21 hdp | $233 |
| **LCD Displays** | |
| AOC 15" LM520 | $365 |
| AOC 17" LM720 | $571 |
| Cornea 15" CT1501 | $352 |
| Cornea 17" MP704 BLK | $579 |
| Cornea 17" CT1700 | $554 |
| Cornea 18" CT1870 | $660 |

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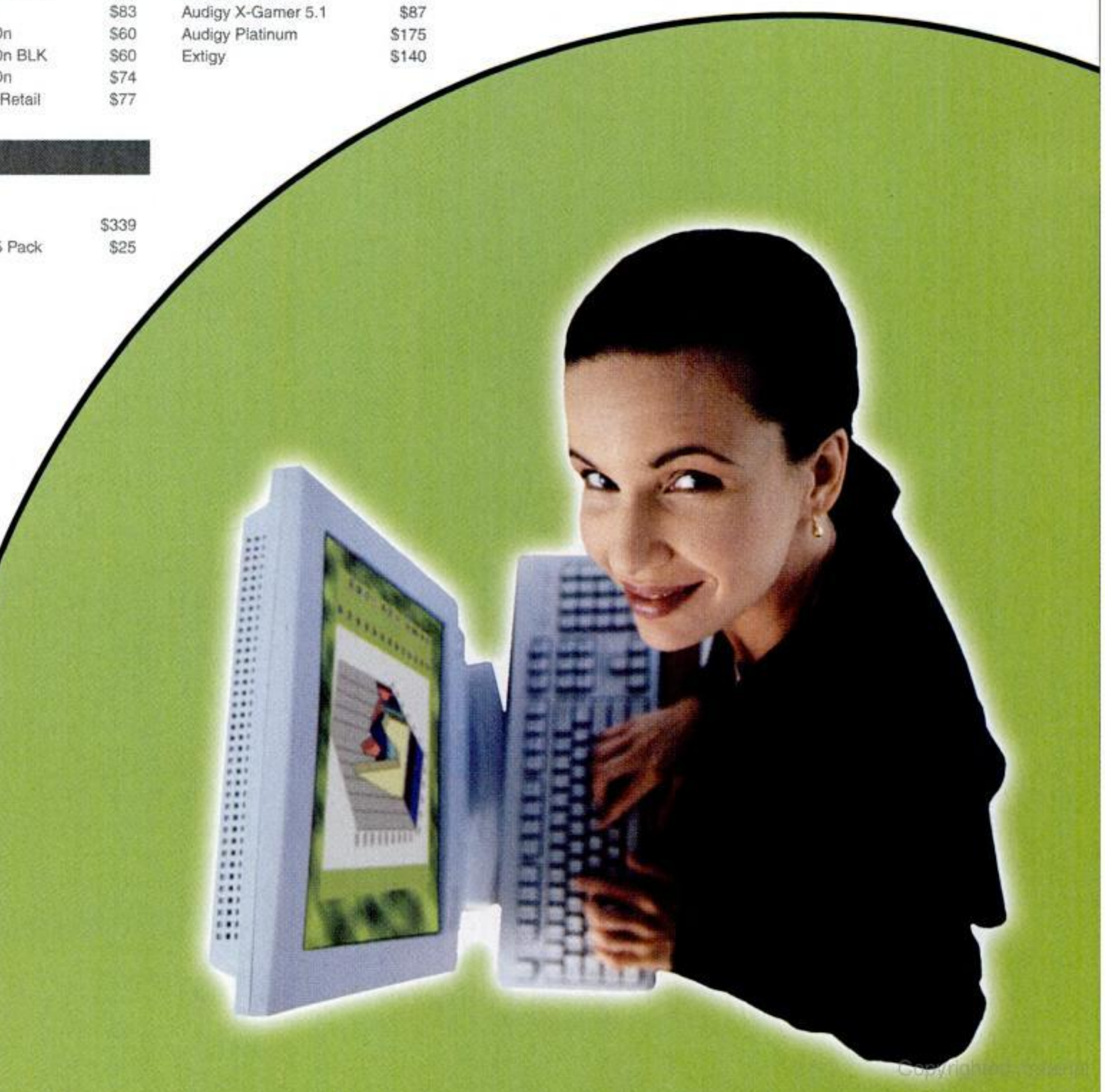

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## IDE Hard Drives

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| **MAXTOR** | | | |
| 20GB | 5400rpm | 2B020H1 | ★ $69 |
| 20GB | 7200rpm | 6L020J1 | $75 |
| 40GB | 5400rpm | 4D040H2 | $76 |
| 40GB | 7200rpm | 6L040J2 | $83 |
| 60GB | 5400rpm | 4D060H3 | $96 |
| 60GB | 7200rpm | 6L060J3 | $101 |
| 80GB | 5400rpm | 4D080H4 | $112 |
| 80GB | 7200rpm | 6L080J4 | $118 |
| 120GB | 5400rpm | 4G120J6 | $169 |
| **SEAGATE** | | | |
| 20GB | 5400rpm | ST320410A | $65 |
| 20GB | 7200rpm | ST320011A | $73 |
| 40GB | 5400rpm | ST340810A | $70 |
| 40GB | 7200rpm | ST340016A | $81 |
| 60GB | 7200rpm | ST360021A | ★ $89 |
| 80GB | 7200rpm | ST380021A | $107 |
| **I B M** | | | |
| 40GB | 7200rpm | 07N8450 | $84 |
| 60GB | 7200rpm | 07N9209 | $103 |
| 80GB | 7200rpm | 07N9210 | ★ $118 |
| 120GB | 7200rpm | 07N9219 | $149 |
| **SAMSUNG** | | | |
| 20GB | 5400rpm | SV2011H | $71 |
| 40GB | 5400rpm | SV4002H | $74 |
| 40GB | 7200rpm | SV4004H | $79 |
| 60GB | 5400rpm | SV6003H | $85 |
| 80GB | 5400rpm | SV8004H | $99 |
| 80GB | 7200rpm | SP8004H | $108 |
| **Western Digital** | | | |
| 20GB | 7200rpm | WD200BB | $73 |
| 40GB | 7200rpm | WD400BB | $85 |
| 60GB | 7200rpm | WD600BB | $107 |
| 80GB | 7200rpm | WD800BB | $120 |
| 80GB | 7200rpm | WD800JB | $130 |
| 100GB | 7200rpm | WD1000BB | $177 |
| 100GB | 7200rpm | WD1000JB | ★ $198 |

**2.5" IDE for Laptops**

| | | | | | |
|---|---|---|---|---|---|
| 10GB | IBM | 9.5mm | 4200rpm | 07N7162 | $78 |
| 10GB | Fujitsu | 9.5mm | 4200rpm | MHR2010AT | $103 |
| 20GB | Toshiba | 9.5mm | 4200rpm | HDD2168 | $100 |
| 20GB | IBM | 9.5mm | 5400rpm | 07N9481 | $130 |
| 20GB | Hitachi | 9.5mm | 4200rpm | DK23DA20F | $98 |
| 30GB | Toshiba | 9.5mm | 4200rpm | HDD2159 | $126 |
| 30GB | IBM | 9.5mm | 4200rpm | 07N8326 | $162 |
| 30GB | Hitachi | 9.5mm | 4200rpm | DK23DA30F | ★ $164 |
| 40GB | Hitachi | 9.5mm | 4200rpm | DK23DA40F | $181 |
| 40GB | IBM | 9.5mm | 4200rpm | 07N8327 | $162 |
| 40GB | IBM | 9.5mm | 5400rpm | 07N9482 | $232 |
| 40GB | Toshiba | 9.5mm | 4200rpm | HDD2166 | $154 |
| 60GB | IBM | 12.5mm | 5400rpm | 07N8328 | $381 |

2.5" to 3.5" Converter Bracket $15

## SCSI Hard Drives

External add $99 SCA versions also available.

| | | | | |
|---|---|---|---|---|
| **MAXTOR** | | | | |
| 18.4GB | 10K rpm | KW018L2 | 8mb | $178 |
| 18.4GB | 10K Ultra320 | KU018L2 | ★ 8mb | $183 |
| 36.7GB | 10K rpm | KW036L4 | 8mb | $266 |
| 36.7GB | 10K Ultra320 | KU036L4 | ★ 8mb | $275 |
| 73.4GB | 10K rpm | KW073L8 | 8mb | $573 |
| 73.4GB | 10K Ultra320 | KU073L8 | ★ 8mb | $579 |
| **SEAGATE** | | | | |
| 18.4GB | 7,200rpm | ST318418N | 2mb | $158 |
| 18.4GB | 7,200rpm | ST318438LW | 2mb | $150 |
| 18.4GB | 10,000rpm | ST318406LW | ★ 4mb | $169 |
| 18.4GB | 15,000rpm | ST318452LW | 8mb | $234 |
| 36.7GB | 10,000rpm | ST336706LW | 4mb | $252 |
| 36.7GB | 15,000rpm | ST336752LW | 8mb | $395 |
| 73.4GB | 10,000rpm | ST373405LW | 4mb | $547 |
| 181GB | 7,200rpm | ST1181677LWV | 16mb | $1336 |
| **I B M** | | | | |
| 18.3GB | 10,000rpm | 07N6350 | 4mb | $169 |
| 18.4GB | 15,000rpm | 07N6800 | 4mb | $238 |
| 36.7GB | 10,000rpm | 07N6340 | 4mb | $239 |
| 36.7GB | 15,000rpm | 07N6801 | 4mb | $381 |
| 146GB | 10K Ultra320 | 08K0322 | ★ 8mb | $1050 |
| 146GB | 10K Ultra320 | 08K0362 | ★ 8mb | $1050 |
| **Hitachi** | | | | |
| 18.4GB | 10,000rpm | DK32DJ-18MW | 4mb | $175 |
| 36.9GB | 10,000rpm | DK32DJ-36MW | 4mb | $279 |
| 73.9GB | 10,000rpm | DK32DJ-72MW | 4mb | $579 |

Ultra320 Drives require Adaptec's Ultra320 Controller to achieve full performance - A39320D $259

## SCSI Externals

| | | | | |
|---|---|---|---|---|
| **MAXTOR** | | | | |
| 18.4GB | 10K rpm | KW018L2 | 8mb | $278 |
| 18.4GB | 10K Ultra320 | KU018L2 | 8mb | $283 |
| **SEAGATE** | | | | |
| 18.4GB | 7,200rpm | ST318418N | 2mb | $258 |
| 36.9GB | 7,200rpm | ST336918LW | 2mb | $313 |
| 18.4GB | 7,200rpm | ST318438LW | 2mb | $250 |
| **I B M** | | | | |
| 18.3GB | 10,000rpm | 07N6350 | 4mb | $269 |
| **Hitachi** | | | | |
| 36.9GB | 10,000rpm | DK32DJ-36MW | 4mb | $379 |

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- Hot swap capability with CRU DataPort™
- RAID controller not included

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## CDRW/DVD Drives

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|---|---|---|---|---|
| **CDRW Drives** | | | | |
| 16x10x40 | IDE | Pacific Digital U-30105 | $69 | $109 |
| 24x10x40 | IDE | BenQ 2410A | $64 | $104 |
| 24x10x40 | IDE | Plextor PXW2410TA/SW | $132 | $147 |
| 24x10x40 | IDE | Yamaha CRW3200EZ | $130 | $170 |
| 32x10x40 | IDE | BenQ 3210A | $61 | $101 |
| 32x10x40 | IDE | GoldStar GCE8320BI | $70 | $110 |
| 32x10x40 | IDE | MSI MS8332 | $59 | $99 |
| 32x12x40 | IDE | Lite-On LTR32123 | $62 | $102 |
| 40x12x48 | IDE | Lite-On LTR40125S | $72 | $112 |
| 40x12x40 | IDE | Plextor PXW4012TA/SW | $145 | $160 |
| 40x12x48 | IDE | Teac CDW540E/KIT | $94 | $134 |
| 40x12x48 | IDE | BenQ 4012P | $70 | $110 |
| 40x12x48 | IDE | TDK VeloCD | $121 | $161 |
| 40x12x48 | IDE | Sony CRX195A1 | $121 | $161 |
| 40x16x48 | IDE | Pacific Digital U-30133 | $69 | $109 |
| 48x12x48 | IDE | Pacific Digital U-30127 | $85 | $125 |
| 48x12x48 | IDE | Lite-On LTR48125S | $90 | $130 |
| 48x16x48 | IDE | BenQ 4816P | $93 | $133 |
| 12x10x32 | SCSI | Plextor PXW1210TS/SW | $215 | $255 |
| 24x10x40 | SCSI | Yamaha CRW3200SZ | $233 | $273 |
| **DVD Drives** | | | | |
| 16x/48x | IDE | Toshiba SDM1612TA | $75 | $100 |
| 16x/40x | IDE | Pacific Digital U-30115 | $59 | $84 |
| 16x/40x | IDE | Pioneer DVD Slot DVD106 | $69 | $94 |
| 16x/40x | IDE | BenQ DVD1648A | $80 | $105 |
| 10x/40x | SCSI | Pioneer DVD305S | $104 | $129 |
| **CD-ROM Drives** | | | | |
| 52x | IDE | Lite-On LTN525 | $35 | $60 |
| 52x | IDE | Creative Labs BLASTER52X | $35 | $60 |
| 52x | IDE | Sony CDU5211 | $40 | $65 |
| 56x | IDE | BTC G621D | $34 | $59 |
| 40x | SCSI | Plextor PX40TSI | $89 | $114 |

All CD/CD-RW/DVD Drives are available in Black, Blue, Silver, Yellow & Green

## USB Drives

| | | | | |
|---|---|---|---|---|
| **USB Hard Drives** | | | | |
| QPS | 40GB | 5400rpm | USB2.0 | $156 |
| QPS | 60GB | 5400rpm | USB2.0 | $205 |
| Buslink | 40GB | 7200rpm | USB2.0 | $173 |
| Buslink | 60GB | 7200rpm | USB2.0 | $190 |
| Buslink | 80GB | 7200rpm | USB2.0 | $238 |
| Buslink | 100GB | 7200rpm | USB2.0 | $334 |

| | | |
|---|---|---|
| **USB Removable Drives** | | |
| Iomega | 100MB Zip Ext USB Drive 31197 | $89 |
| Iomega | 250MB Zip Ext USB Drive 31310 | $142 |
| Iomega | Peerless USB Drive w/10GB 31772 | $234 |

| | | |
|---|---|---|
| **USB CDRW Drives** | | |
| Plextor | 24x10x40 USB 2.0 CD-RW | $182 |
| Iomega | 24x10x40 USB 2.0 CD-RW | $181 |
| Yamaha | 24x10x40 2.0 CD-RW | $196 |
| Pacific Digital | 24x10x40 USB 2.0 | $119 |
| Pacific Digital | 32x12x48 USB 2.0 Kit | $143 |

| | | | |
|---|---|---|---|
| **USB DVD Recorders** | | | |
| QPS | USB 2.0 DVD-R | QPDVRPN1U2 | $440 |
| QPS | USB 2.0 DVD-R CD-RW | QPDVRPR1U2 | $488 |

| | | | |
|---|---|---|---|
| **USB DVD/CDRW Combo** | | | |
| Sony | USB 2.0 20x8x24/8x | CRX85UA2 | $274 |

Orange Micro offers a wide range of USB 2.0 Products. Check our site for details
**harddrive.com/orangemicro**

## Controller Cards

Pacific Digital
DISCSTAQ ADMA Enterprise ATA Controller
Supports Command Queing, freeing up CPU for other tasks. $149.99

| | | | | |
|---|---|---|---|---|
| **SCSI Controllers** | | | | |
| Adaptec | RAID 2000S | $225 | 19160 Kit | $219 |
| Adaptec | RAID 2005S | $224 | 29160 Kit | $295 |
| Adaptec | RAID 3210S | $654 | 29160N Kit | $279 |
| Adaptec | RAID 3400S | $814 | 39160 Kit | $340 |
| Adaptec | RAID 5400S | $1163 | | |
| Adaptec | DuraStor 6200SS Bundle Kit | | | $6025 |
| Adaptec | DuraStor 7220SS Bundle Kit | | | $7381 |

| | | |
|---|---|---|
| **IDE Controllers** | | |
| Adaptec | ATA RAID 1200A Kit | $84 |
| Adaptec | ATA RAID 2400A Kit | $320 |
| Promise | ATA133 Card ULTRA133TX2 | $49 |
| Promise | ATA100 2ch RAID FASTTRAK100TX2 | $87 |
| **Firewire Controllers** | | |
| Adaptec | 1394/Firewire CardBus Kit | $79 |
| Orange Micro | Firewire 3 Port PCI Card | $49 |
| **USB Controllers** | | |
| Adaptec | USB 2.0 2-port CardBus Kit | $75 |
| Orange Micro | USB 2.0 4 Port PCI Card | $55 |

## Firewire Drives

| | | | | |
|---|---|---|---|---|
| **Firewire Hard Drives** | | | | |
| Buslink | 60GB | 7200rpm | FW6072E | $190 |
| Buslink | 80GB | 7200rpm | FW8072E | $238 |
| Buslink | 100GB | 7200rpm | FW10072W | $285 |
| Buslink | 120GB | 7200rpm | FW12072W | $313 |
| Maxtor | 80GB | 5400rpm | X01FWRA080 | $212 |
| Maxtor | 80GB | 7200rpm | Y01FWRA080 | $242 |
| Maxtor | 160GB | 5400rpm | X01FWRA160 | $347 |
| QPS | 60GB | 7200rpm | QPM3HD72F60L | $212 |
| QPS | 80GB | 7200rpm | QPM3HD72F80L | $235 |
| QPS | 100GB | 7200rpm | M3HD72F100L | $338 |
| **Firewire CDRW Drives** | | | | |
| QPS | 32x10x40 | | CRW321040FL | $187 |
| QPS | 40x12x48 | | CRW401240FL | $222 |
| Yamaha | 24x10x40 | | CRW3200FXZ | $256 |
| Iomega | 40x12x48 | | 32359 | $211 |
| **Firewire DVD Drives** | | | | |
| Addonics | 8X DVD/24X | | DVD8X24FW | $293 |
| LaCie | DVD-R/RW & CDRW | | 300164 | $468 |

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**Socket 478 Mobo**
850E Chipset
1066 RDRAM
USB 2.0 - LAN
**$143**

**Seagate 40GB Barracuda IV**

Ultra ATA/100
7200rpm - 9ms
2MB Cache
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**Creative Labs Audigy Platinum Silver**
Silver Audigy Drive
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**$201**

**Intel P4 533 2.8GHz**
Intel Pentium 4
2.8GHz Socket 478
512KB Retail
**$569**

## Processors

| AMD | | INTEL | | | |
|---|---|---|---|---|---|
| 1.2GHZ Duron | $51 | Xeon 1.8GHz 512 cache | | | $207 |
| 1.3GHZ Duron | $63 | Xeon 2GHz 512 cache | | | $243 |
| Athlon XP1700+ | $86 | Xeon 2.2GHz 512 cache | | | $284 |
| Athlon XP1800+ | $97 | Xeon 2.4GHz 512 cache | | | $284 |
| Athlon XP1900+ | $114 | P4 2.26GHz | 512k | 533 | $230 |
| Athlon XP2000+ | $121 | P4 2.4GHz | 512k | 533 | $232 |
| Athlon XP2100+ | $151 | P4 2.53GHz | 512k | 533 | $289 |
| Athlon XP2200+ | $182 | P4 2.6GHz | 512k | 533 | $472 |
| Athlon XP2400+ | $259 | P4 2.66GHz | 512k | 533 | $472 |
| Athlon XP2600+ | $359 | P4 2.8GHz | 512k | 533 | $595 |

## F18 Hornet Gaming System

Intel® Pentium® 4 Processor at 2.8GHz
Asus P4T533-C 533MHz w/LAN
ATI Radeon 9700 128MB w/Tv-Out
512MB PC1066 DRDRAM Non ECC
PDC 16X/40X DVD-ROM
Creative Labs Audigy Platinum
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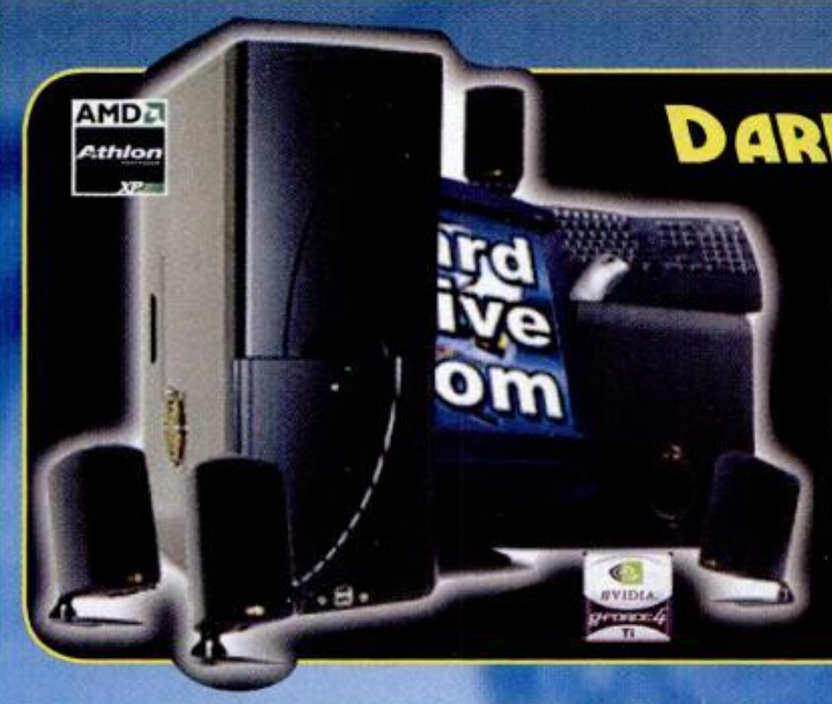
Cold Cathode & Matching Drives
Enermax EG465P-VE 420W PS
**$2,650**
Monitor & Klipsch Promedia 5.1 Sold Separately

## Motherboards

| SOCKET A Call for a great deals on a processors!! | | | | |
|---|---|---|---|---|
| Asus | A7V8X/A | $120 | A7V8X/A/L/SATA | $142 |
| | A7V333AU2 | $114 | A7V333ARU2F | $137 |
| | A7M266 | $85 | A7N266VM | $73 |
| Abit | KX7-333 | $89 | AT7 | $141 |
| | KX7-333R | $96 | KD7 | $114 |
| Gigabyte | GA-7VAX | $90 | GA7VRX | $79 |
| | GA-7ZXE | $55 | GA-7VKML | $65 |
| MSI | K7N420PRO | $134 | KT3ULTRA2 | $82 |
| | KT4ULTRA | $100 | KT4ULTRA-SR | $118 |
| Iwill | XP333 | $79 | XP333R | $95 |
| **SOCKET 370** (Flip Chip/Celeron) | | | | |
| Asus | TUSL2C-SWA | $97 | TUV4X | $74 |
| Intel | D815EGEWU | $94 | D815EGEWLU | $104 |
| **SOCKET 478** (Pentium 4) | | | | |
| Asus | P4B533-E/LAN | $155 | P4B533 | $125 |
| | P4T533-C/LAN | $164 | P4T533 | $170 |
| | P4B533-V | $153 | P4B266-C | $103 |
| Abit | IT7 | $141 | BD7II | $90 |
| | BG7 | $96 | BD7II-R | $107 |
| Iwill | P4D | $85 | P4R533N | $145 |
| | mP4G | $115 | | |
| Intel | D850MVSE | $144 | 850EMV2L | $158 |
| | D850MV | $136 | 845PEBT2 | $142 |



## Dark Knight 2200XP

AMD Athlon™ XP2200+ Processor at 1.8GHz
Dark Knight KickAss Black Hydraulic Modded Case
Case includes 12"Cold Cathode & Clear Acrylic Window
Asus ATA133, RAID 0/1, USB 2.0
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WD 120GB Caviar, 7200rpm
Audigy X-Gamer
VisionTek nVidia Geforce-4 TI4600 128MB DDR,w/TV out & DVI
Pacific Digital 48x12x48 IDE CDR-W Black Color
Pacific Digital 16/40 IDE DVD Black Color
Windows XP Home
1.44MB Floppy Black
**$1,399**
Monitor Sold Separately

## Video Cards

| | | |
|---|---|---|
| **ATI** | | |
| 100-430283 | RADEON 7000 64MB | $64 |
| 100-432001 | RADEON 7500 64MB | $91 |
| 100-431022 | RADEON 8500 128MB | $171 |
| 100-433001 | RADEON 9000P 64MB | $129 |
| 100-433002 | RADEON 9000P 128MB | $155 |
| 100-434003 | RADEON 9700P 128MB | $364 |
| 100-710002 | AIW RADEON 8500DV 64MB | $182 |
| 100-710030 | AIW RADEON 8500 128MB | $273 |
| **EVGA** | | |
| 064A4NV70S1 | GEFORCE4 MX440 64MB | $90 |
| 064A4NV76S1 | GEFORCE4 TI4200 64MB | $157 |
| 128A4NV78S1 | GEFORCE4 TI4200 128MB | $166 |
| 128A4NV82S1 | GEFORCE4 TI4600 128MB | $258 |
| **MSI** | | |
| MX400DT64 | GEFORCE2 MX400 64MB DDR | $57 |
| G4MX440VTP | GEFORCE4 MX440 64MB | $88 |
| 8870-030 | GEFORCE4 TI4200 64MB | $141 |
| 8870-040 | GEFORCE4 TI4200 128MB | $166 |
| 8872-010 | GEFORCE4 TI4600 128MB | $259 |
| **PNY** | | |
| VCGX2A32SPB | GEFORCE2 MX200 32MB | $51 |
| VCGF4TI42APB | GEFORCE4 TI4200 64MB | $47 |
| VCGF4TI44APB | GEFORCE4 TI4400 128MB | $208 |
| VCGF4TI46APB | GEFORCE4 TI4600 128MB | $249 |

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Seagate 40GB 7200rpm 2MB Buffer
Windows XP Home
64MB Video
56k V.90 Modem
10/100 Ethernet
**$725**
Monitor Sold Separately
Viewsonic Silver & Black 17" P70F $227

## Silver Hawk Extreme

Intel® Pentium® 4 Processor at 2.8GHz 533MHz Front Side Bus
Adaptec Ultra320 SCSI
140GB Seagate 15K Cheetah
512MB PC1066 DRDRAM Non ECC
Asus P4T533-C 533MHz
ATI Radeon 9700 128MB
ThermalTake XaserII 6000
12" Cold Cathode, Case Fans w/Blue Hardcano, Rounded Cables
40x12x40 Plextor CDRW Silver
Thermaltake P4 Volcano
Led Fans, Neon Switch,
Enermax 550W Power Supply
Pacific digital 16X/40X Silver DVD
Creative Labs Audigy X-Gamer
**$2,759**

## Sound Cards

| | | |
|---|---|---|
| Creative Labs | Audigy X Gamer 5.1 | $93 |
| Creative Labs | Audigy MP3+ | $89 |
| Creative Labs | Audigy Platinum | $176 |
| Creative Labs | Audigy Platinum eX | $221 |
| Creative Labs | Sound Blaster Extigy | $133 |
| Turtle Beach | SantaCruz 512 Voice | $71 |

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Enhanced 11/22 Mbps
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Includes Cradle, Keyboard, Case & Parallel Adapter

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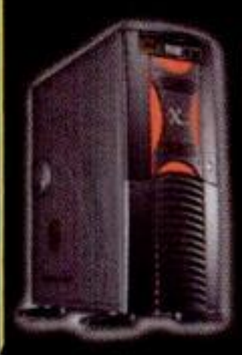

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860BLKWN Hydraulic case with window & neon 300watt power

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SF860USB Hydraulic case with front usb 300watt Power

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Cooler Master ATC210WN320 12" Blue Cold Cathode 320watt Power

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Antec SX-1240 Performance Series FULL TOWER 400W CASE

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Antec SX1040B 10 Bay Black Per-formance Series Workstation with 300 Watt

**$145**

Antec SX1030 10 Bay Black Per-formance Series Workstation with 300 Watt

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- 300 Watt EG301P-VE $47
- 350 Watt EG365P-VE $55
- 430 Watt EG465P-VE $84
- 550 Watt EG651P-VE $155

Dual Wisper Fan P4 Ready
- 350 Watt 365P-VE $64

### Antec Power Supplies

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|---|---|---|
| 330W | TRUE330 | $56 |
| 380W | TRUE380 | $75 |
| 430W | TRUE430 | $80 |
| 550W | TRUE550 | $115 |
| | TRUEBLUE480 | $105 |
| | 510W FOR DUAL AMD | $105 |

## PC Mods

### Fans & Grills

#### Fan Grills

Radiation
80mm $17
92mm $19
120mm $22

Biohazard
80mm $18
92mm $20
120mm $24

Atomic
80mm $17
92mm $19
120mm $22

Swirl
80mm $19
92mm $22
120mm $25

Standard Grills

| | | |
|---|---|---|
| ThorTek | 80mm | $6 |
| ThorTek | 92mm | $7 |
| ThorTek | 120mm | $8 |

Case Fans

| | | |
|---|---|---|
| Sunon | 80mm | $13 |
| Sunon | 92mm | $17 |
| Sunon | 120mm | $21 |

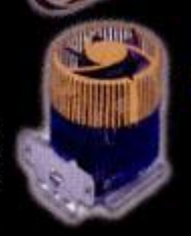
Thermaltake Active Memory Cooling Kit PC2100/PC100/133

**$19**

#### CPU Fans

Thermaltake Volcano 9 AMD Athlon XP up to 2600+

**$27**



Thermaltake DRAGON ORB 3 AMD Athlon 1.5GHz+

**$29**

Thermaltake VOLCANO 7 INTEL Socket 370 & AMD Socket 462

**$19**

Thermaltake VOLCANO 7+ Intel™ P4 478 & AMD™ Athlon XP

**$29**

Arctic Silver III 99.8% pure micronized silver compound

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Thermaltake Crystal Orb VGA Card Chip Cooler

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Thermaltake Golden HardCano 5 Hard Drive Cooler

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Zalman Pure Aluminum And Copper Combined CPU Cooler For Socker A(462) and 370. Zalman's CPU Coolers do not generate noise and vibration in Silent Mode.

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|---|---|
| 10" Neon Accent (Blue, Green, Red, Black) | $24 |
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| 6' Neon Glow Wire (White, Red) | $39 |
| Neon Power Adapter (standard power connector) | $2 |

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|---|---|
| Bio-Hazard Etched Applique | $12 |
| Atomic Etched Applique | $8 |
| Radio Active Etched Applique | $8 |

### Water Cooling Kits

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|---|---|---|
| CPUFX | Complete Water Cooling Kit | $199 |

### Window Kits

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|---|---|
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7200rpm - 8.5ms
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64MB VIDEO - 10/100
56K V.90 - USB
AUDIO - 320W 7 BAY

**$209**

**ATI Radeon 9700 Pro AGP**

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128MB with TV Out

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Creative Labs Audigy Platinum - Available in Black, Silver, Yellow, Blue & Green

**$201**

Keyboard Mouse Speaker Combo Kits available in the same assorted colors!

**$35**

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|---|---|---|
| 18" | Rounded Ultra ATA Cable | $10.00 |
| 24" | Rounded Ultra ATA Cable | $15.00 |
| 36" | Rounded Ultra ATA Cable | $15.00 |
| 24" | Rounded Ultra Floppy Cable | $10.00 |

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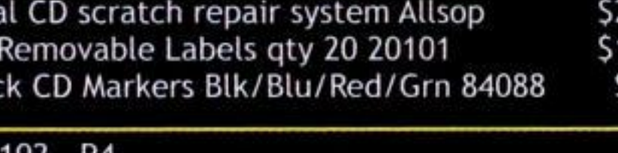

# Media

**CD &CD-RW Media**

| | |
|---|---|
| 24X 80Min 100 Spindle LED1C | $47 |

See our web site for other incredible prices!

**DVD Media**

| | |
|---|---|
| DVD-R 4.7GB Single Side 01892 | $5.95 |
| DVD-R 4.7GB Single Side 50 SPindle R470S50 | $266 |
| DVD+R 4.7GB Single Side 16022 | $7.25 |

**CD/CD-RW/DVD Accessories**

| | |
|---|---|
| Drive Cleaner Allsop 23934 | $16.99 |
| Disc cleaning wipes Allsop 50100 | $4.99 |
| CD scratch repair system Allsop 58200 | $11.99 |
| Radial CD scratch repair system Allsop | $27.99 |
| Disc Removable Labels qty 20 20101 | $11.99 |
| 4 pack CD Markers Blk/Blu/Red/Grn 84088 | $6.99 |

# Monitors

**BenQ**

| | | | | | |
|---|---|---|---|---|---|
| V772 | 17" | CRT | 1280x1024 | .23mm | $159 |
| FP751 | 17" | LCD | 1280x768 | .264mm | $649 |
| FP2081 | 20.1" | LCD | 1600X1200 | .25mm | $1909 |

**Samsung**

| | | | | | |
|---|---|---|---|---|---|
| 151S | 15" | LCD | 1024x768 | .297mm | $389 |
| 170MP | 17" | CRT | 1280x1024 | .25mm | $179 |

**Viewsonic**

| | | | | | |
|---|---|---|---|---|---|
| E70F | 17" | CRT | 1280x1024 | .24mm | $189 |
| G70FMB | 17" | CRT | 1280x1024 | .23mm | $209 |
| E90FMB | 19" | CRT | 1600X1200 | .21mm | $279 |
| LCD17M | 17" | LCD | 1280x1024 | .264mm | $689 |
| VE800 | 18.1" | LCD | 1280X1024 | .25mm | $939 |
| VP201MB | 20.1" | LCD | 1600X1200 | .294mm | $1699 |
| VP230MB | 23.1" | LCD | 1600x1200 | .294mm | $3289 |

# Speakers

**Creative Labs**

| | | | |
|---|---|---|---|
| Inspire4400 | 5pc | 41W | $52 |
| Inspire5300 | 6pc | 48W | $83 |
| Inspire5700 | 6pc | 79W | $242 |
| SW320 | 3pc | 21W | $40 |
| FPS1600 | 5pc | 45W | $52 |

**Logitech**

| | | | |
|---|---|---|---|
| Z560 | 5pc | 400W | $155 |
| Z540 | 5pc | 40W | $69 |
| Z340 | 3pc | - | $242 |

**Altec Lansing**

| | | | |
|---|---|---|---|
| 621 | 3pc | 200W | $112 |
| 641 | 5pc | 400W | $145 |
| ATP3 | 3pc | - | $59 |
| ATP4 | 5pc | 80W | $110 |
| AL2100 | 3pc | 40W | $73 |
| AL4100 | 5pc | 140W | $110 |

# Networking

**Network Hubs**

| | |
|---|---|
| 3Com OfficeConnect 8 Port Hub | $85 |
| 3Com 16 Port Eth. Hub | $179 |
| Linksys 24-Port Hub | $239 |
| D-Link 5 Port Switch | $75 |
| Netgear 16-Port Hub 10/100 | $189 |
| Linksys 8-Port 10/100 Hub | $67 |

**Network Cards**

| | |
|---|---|
| Jaton 10/100 PCI Eth. Card | $17 |
| Netgear 10/100 PC Card | $64 |
| D-Link 10/100 PCI Eth. Card | $27 |
| ConnectGear 10/100 PCMCIA | $29 |
| LANPRO PCI 10/100 Ethernet Card | $50 |
| Intel PRO/100+ Fast Ethernet PCI | $55 |
| Netgear PCI 10/100BaseTX NIC | $20 |
| Generic 10/100 PCI | $15 |
| Allied Telesyn 10/100 PCMCIA | $53 |
| Intel Pro/100S CardBus 10/100 | $84 |
| Xircom PCMCIA 10/100 and 56K Modem | $114 |
| Intel CardBus II 10/100 w/RealPort | $48 |

**Network Routers**

| | |
|---|---|
| Linksys Wrls Router w/4 Port | $169 |
| Linksys Router 8-Port | $133 |
| SOHO 17 Port 10BASE-T/2 Hub | $89 |

**Print Servers**

| | |
|---|---|
| Linksys Wireless Print Server | $112 |
| Hawking 3-Port Eth. Print Server | $159 |

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**HERCULES XP1900**

**$675**

17" Flat CRT Monitor Included!!

AMD Athlon™ XP1900 Processor at 1.6GHz
Keyboard/Mouse Combo, & speakers

| | |
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| 512MB PC133 SDRAM | 64MB Video |
| 48x12x48 CD-RW Drive | 56k V.90 Modem |
| 40GB 7200rpm 2MB Buffer | 10/100 Ethernet |
| Windows XP Home | |

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The Perfect solution for your home or business

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SMC2755W
**EZ Connect 802.11a Wireless Access Point**
**$366**

LINKSYS

WCF11
**11Mbps Wireless Network CF Card $112**

WPS11
**EtherFast 11Mbps Wireless Print Server $112**

WPS11
**EtherFast Wireless AP+ Cable/DSL Router with 4 port switch $169**

WPC11
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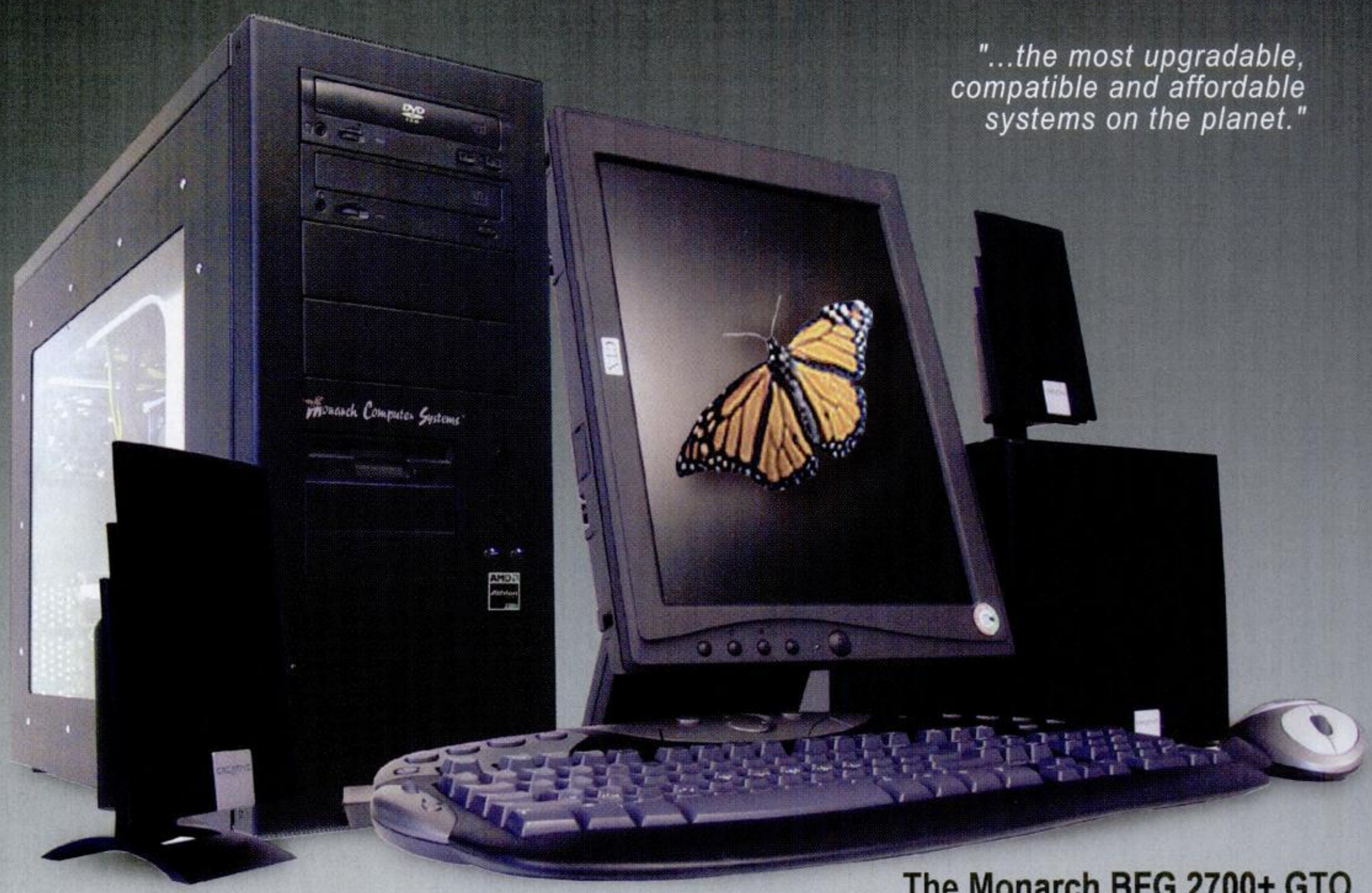


## The Monarch BFG 2700+ GTO

Monitor, keyboard, mouse & speakers sold seperately

**See specs below**

Part# 90759

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Part# 90007

Mid-Tower ATX with 350W PS

MSI K7N 420 Pro nForce Video/LAN DDR (AMD)
- ASUS ACR Audio Module with SPDIF-in/out interface
- Realtek RTL 8139 10/100 Mbps LAN controller
- integrated nVidia GeForce2 Graphics Core

AMD Athlon™ XP 1800+ Processor with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 1.8 GHz processors
*Quantispeed™ architecture operates at 1.533 GHz

Dynatron DC1206BM-L/610-T
256 MB DDR 2100 Corsair Memory
Western Digital 40 GB 7200rpm Hard Drive
Lite-On 40x12x48 CD-RW with Software
1.44 MB 3.5" Floppy Drive
Optionsl Video Card upgrade
Lucent 56K v.92 Modem
Microsoft Windows XP Home Edition
Limited 1 Year Warranty (Optional 3 Year)

**$699.00**

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Part# 90222

Lian-Li PC70 Aluminum Server Case w/460W PS
Tyan S2468UNG MPX SCSI Dual MP Motherboard
(2) AMD Athlon™ MP 2200+ Processors with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 2.2 GHz processors
*Quantispeed™ architecture operates at 1.80 GHz
(2) Dynatron DC1206BM-L/610-T Heatsink Fans
1 GB DDR REG ECC Corsair Memory (Upgrade to 3 GB)
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Sony 16x DVD, 40x CD-ROM
Lite-On 48x12x48 CD-RW
1.44 MB 3.5" Floppy Drive
Creative Labs Live 5.1 Sound Card
Matrox Millennium G450 16MB AGP Video Card
Dual 3Com 3C920 LAN Controllers On Board
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Part# 90759

Lian-Li PC60 Black Aluminum Case w/430W PS
Lian-Li PC60 Black Clear Side Panel
MSI KT400 MS6590-020 8X RAID Motherboard
AMD Athlon™ XP 2700+ Processor with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 2.7 GHz processors
*Quantispeed™ architecture operates at 2.47 GHz
Dynatron DY1206BH-610 Heatsink Fans
512 MB 3200 CAS 2 DDR Corsair Memory
(2) WD 80GB 800JB 8MB Cache 7200rpm HDDs
Lite-On Black 16x DVD 48x CD-ROM
Lite-On Black 40x12x48 CD-RW with Software
1.44 MB 3.5" Floppy Drive
ATI Radeon 9700 Pro 128MB 8X AGP Video Card
Lucent 56K v.92 Modem
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Part# 100390

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## Cases

(Most cases do not include power supply)

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|---|---|
| Lian-Li PC72 Aluminum Server | $298 |
| Lian-Li PC70 Aluminum Server | $179 |
| Lian-Li PC60 Aluminum Case | $129 |
| Lian-Li PC7 Aluminum Case | $99 |
| Lian-Li Clear Side Panel for PC70 | $ 59 |
| Lian-Li Clear Side Panel for PC60 | $ 45 |
| Monarch Mid CS-501 Black/Silver w/300W PS | $ 59 |
| Enlight Tower/Servers/Rackmount | $ 38-499 |
| 4U, 2U & 1U Rack Servers | $159-499 |
| Enermax Mid Case Black/Purple/White | $ 79 |

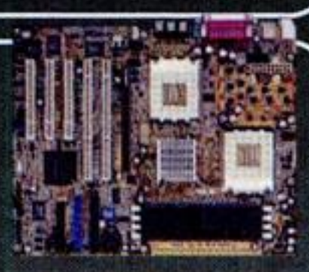
## Power Supplies

| | |
|---|---|
| 250 Watt ATX Generic/Sparkle | $ 7-25 |
| 300 Watt ATX Generic/Sparkle | $ 12-30 |
| 400 Watt ATX Sparkle Power Supply | $ 89 |
| 430 Watt Enermax Whisper ATX | $ 89 |
| 460 Watt ATX Sparkle | $125 |
| 460 Watt SPI Sparkle FSP460-AMD MP | $ 95 |
| 550 Watt Enermax EG651P-VE (FMA) | $137 |

Redundant and hot-swappable power supplies available

## Motherboards

Abit - Asus - MSI - Tyan - Soyo-Tek - VIA
Biostar - DFI - Gigabyte - Intel - SuperMicro



| | |
|---|---|
| Asus A7M266-D Dual MP | $215 |
| MSI KT4 Ultra-SR KT400 RAID 8X AGP DDR | $127 |
| Gigabyte KT400 7VAX 8X AGP DDR | $ 85 |
| AMD 266 FSB Socket A | $ 55-79 |
| AMD VIA KT 333+ | $ 69-149 |
| SOYO SY-KT400 Dragon Ultra RAID DDR | Call |
| Tyan Dual MPX Socket A | $168-459 |

All Motherboards are Retail Box Includes: Manuals, Cables & Drivers

## Processors

| | | |
|---|---|---|
| AMD Athlon™ XP 2700+ | .13 micron | $359 |
| AMD Athlon™ XP 2600+ | .13 micron | $299 |
| AMD Athlon™ XP 2400+ | .13 micron | $199 |
| AMD Athlon™ XP 2200+ | .13 micron | $143 |
| AMD Athlon™ XP 2000+ | | $ 94 |
| AMD Athlon™ XP 1900+ | | $ 99 |
| AMD Athlon™ XP 1800+ | | $ 67 |
| AMD Athlon™ MP 2200+ | .13 micron | $219 |
| AMD Athlon™ MP 2000+ | | $145 |
| AMD Athlon™ MP 1800+ | | $133 |

## Memory

Memory upgrades for all motherboards in stock

CORSAIR

| | |
|---|---|
| 256 MB DDR Corsair 2100 | $ 69 |
| 512 MB DDR Corsair 2100 | $149 |
| 256 MB DDR 2700 CAS-2 (333) Corsair | $ 95 |
| 512 MB DDR 2700 (333) Samsung | $149 |
| 512 MB DDR Corsair 3200 CAS-2 | $182 |
| 1 GB DDR REG ECC Corsair | $409 |
| 1 GB DDR REG ECC | $346 |
| PC133 128-256-512 MB | $ 32 / 48 / 99 |

Please call for current prices. Prices subject to change without notice.

## Hard Drives

IBM - Maxtor - Seagate - Western Digital

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| | |
|---|---|
| *40 GB 7200 rpm ATA100 HD from:* | *$ 72* |
| 80 GB 7200 rpm ATA133 HD from: | $ 99 |
| 100 GB 7200 rpm ATA133 HD from: | $120 |
| 120 GB 7200 rpm ATA133 HD from: | $169 |
| 160 GB 7200 rpm ATA133 HD from: | $259 |
| 80 GB 800JB SE 8MB Cache 7200 rpm | $107 |
| 100 GB 1000JB SE 8MB Cache 7200 rpm | $123 |
| 120 GB 1200JB SE 8MB Cache 7200 rpm | $179 |

## Video Cards

Matrox graphics solutions provider. Please call for more information.

| | |
|---|---|
| Albatron/Monarch Ti4600 128MB AGP TV-Out DVI | $221 |
| MSI GeForce4 Ti4600 128MB AGP | $239 |
| ATI Radeon 9700 Pro 128MB 8X AGP | $359 |
| ATI 8500 All-In-Wonder Radeon 64MB DDR | $198 |
| ATI 7500 All-In-Wonder Radeon 64MB AGP | $159 |
| ATI Fire GL 8700 64MB AGP | $129 |
| ATI XPert 2000 Pro 32MB AGP | $ 39 |
| Leadtek WinFast TV2000 XP | $ 67 |
| Leadtek GeForce4 Ti4200 64MB AGP | $148 |
| Leadtek GeForce4 A250 Ti4600 128MB AGP | $245 |

## Cables & Thermal Fans

Thermaltake 3-in-1 Smart & Silent Volcano 9 $18.00

Thermaltake 3-in-1 Memory Cooling Kit $10.00

| | |
|---|---|
| 24" Round ATA 66/100 IDE | $14-15 |
| 18" 2 Device ATA 133 | $17 |
| Round Floppy Cable | $10 |

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Go to www.monarchcomputer.com, click on Components/Cases. Choose Barebone, then Case, then Motherboard Combos (Motherboard, CPU & Heatsink Fan) or call 8.Monarch.PC

Lian-Li PC 70 Case w/ 400W PS
Asus A7M266-D (LAN) Dual AMD MP
(2) AMD Athlon™ MP 2200+ Processors
with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 2.2 GHz processors
*Quantispeed™ architecture operates at 1.80 GHz
(2) Dynatron DY1206BH-610 Fan
Part#s 1000123, 110425, 120606, 130979 **$995**

Lian-Li PC 60 Case w/400W PS
Asus A7V333 KT333+ DDR
AMD Athlon™ XP 2000+ CPU
with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 2.0 GHz processors
*Quantispeed™ architecture operates at 1.67 GHz
Coolermaster CP5-6J11C-01 Fan
Part#s 1000053, 110422, 120501, 130113 **$449**

Enermax ATX Case w/430W PS
Gigabyte KT400 7VAXP 8X AGP RAID DDR 400
AMD Athlon™ XP 2200+
with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 2.2 GHz processors
*Quantispeed™ architecture operates at 1.80 GHz
Dynatron DY 1206BH-610 Fan
Part#s 1000234, 110030, 120500, 130979 **$459**

Mid-Tower ATX w/ 350W PS
Gigabyte GA-7VRX KT333+ DDR
AMD Athlon™ XP 1800+ CPU
with Quantispeed™ Architecture
*Quantispeed™ architecture outperforms competitive 1.6 GHz processors
*Quantispeed™ architecture operates at 1.533 GHz
Coolermaster CP5-6J11C-01 Fan
Part#s 100014, 110012, 120503, 130113 **$221**

# Monarch Custom Systems

## AMD Home & Office Custom PC

Part # 80811

Mid-Tower ATX USB w/300 or 350 W PS
Gigabyte GA-7VRX KT333+ DDR MB
AMD XP Processor Options
256 MB to 1 GB Memory Options
40-120 GB Hard Drive Options
CD, DVD and CD-RW Options
Mitsumi 1.44 MB Floppy Drive
Zip Drive Options
Sound Card Options
Video Card Options
Optional Lucent 56K v.92 Modem
Choose Microsoft Windows XP Professional or Home Edition
1-3 Year Warranty Options

*Starting in the mid $500's*

## The AMD Custom Gaming System

Part # 80814

Lian-Li PC60 Aluminum Case w/430W PS or Enermax/Monarch 305-S Tower w/350W PS
Gigabyte GA-7VRXP KT333+ RAID DDR MB
AMD XP Processor Options
256 MB to 1 GB Memory Options
1 or 2, 40-120 GB Hard Drive Options
Optional RAID setup
CD, DVD, CD-RW & DVD-RW Options
Mitsumi 1.44 MB Floppy Drive
Sound Card Options
Video Card Options
Optional Lucent 56K v.92 Modem
Choose from Windows 2000 Pro or Windows XP Professional
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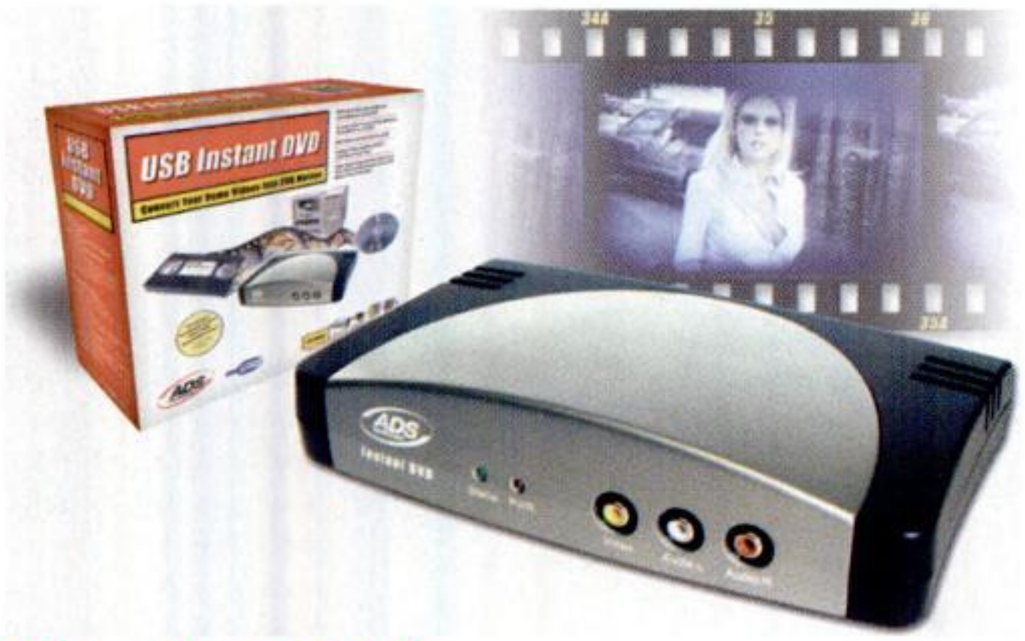


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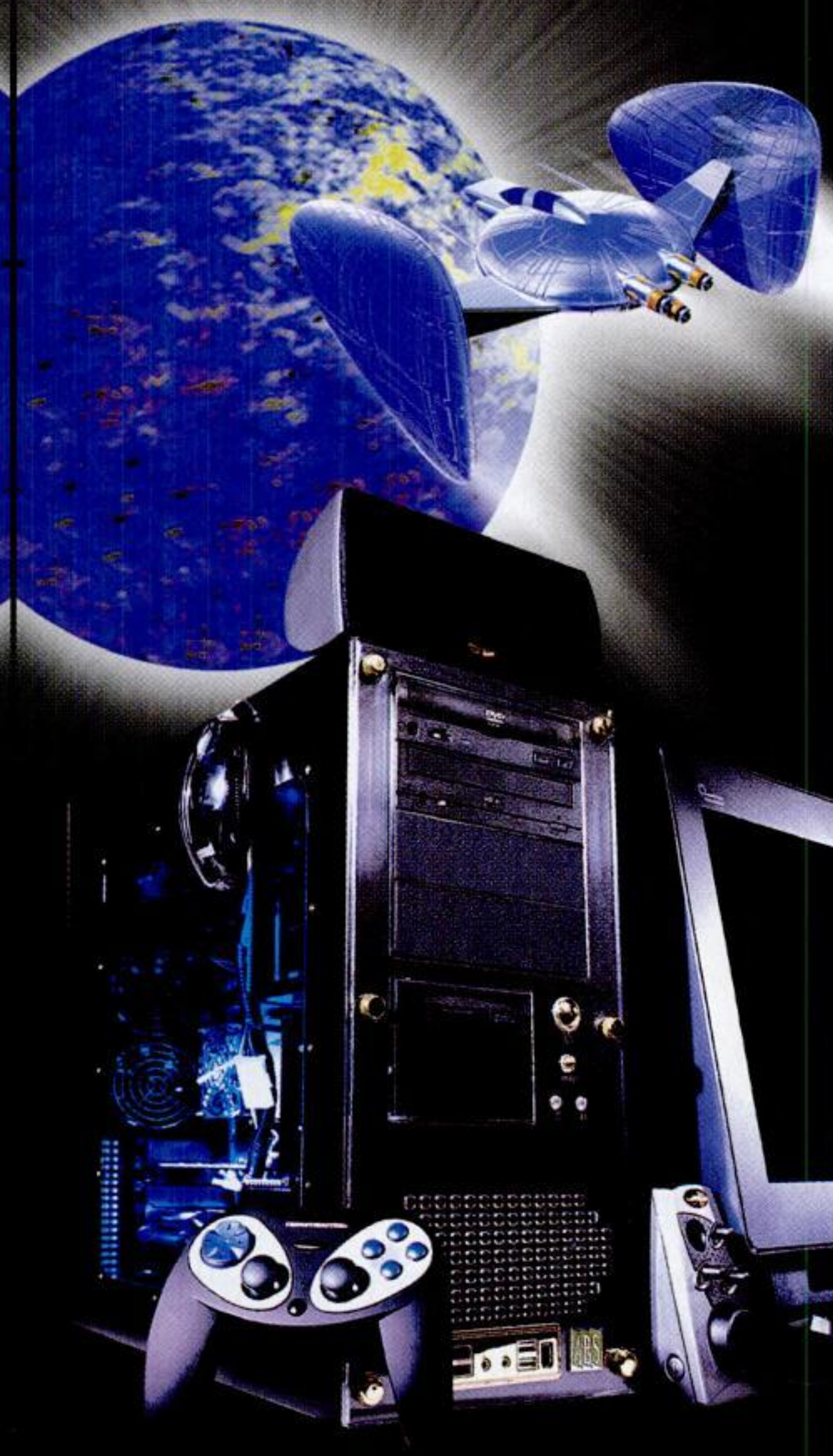

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Microsoft Windows® XP Professional
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Two 80GB 7200RPM Ultra ATA 133 Hard Drives
HighPoint RAID 133 Controller Card
Lite-On 16X DVD Player & Mitsumi 1.44MB Floppy Drive
Plextor 40X12X40 CD-ReWritable Drive
Sapphire Radeon 9700 Pro w/128MB DDR DVI & TV-Out Powered by ATI
Creative Labs SoundBlaster Audigy XGamer Sound Card w/IEEE 1394
Integrated Intel Network Controller
Black Multimedia Keyboard & Optical Mouse
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| NEC 21" FE1250 | Black | $649.00 |

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### CREATIVE Speakers

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| Cambridge Soundworks Megaworks 5.1 | $269.00 |

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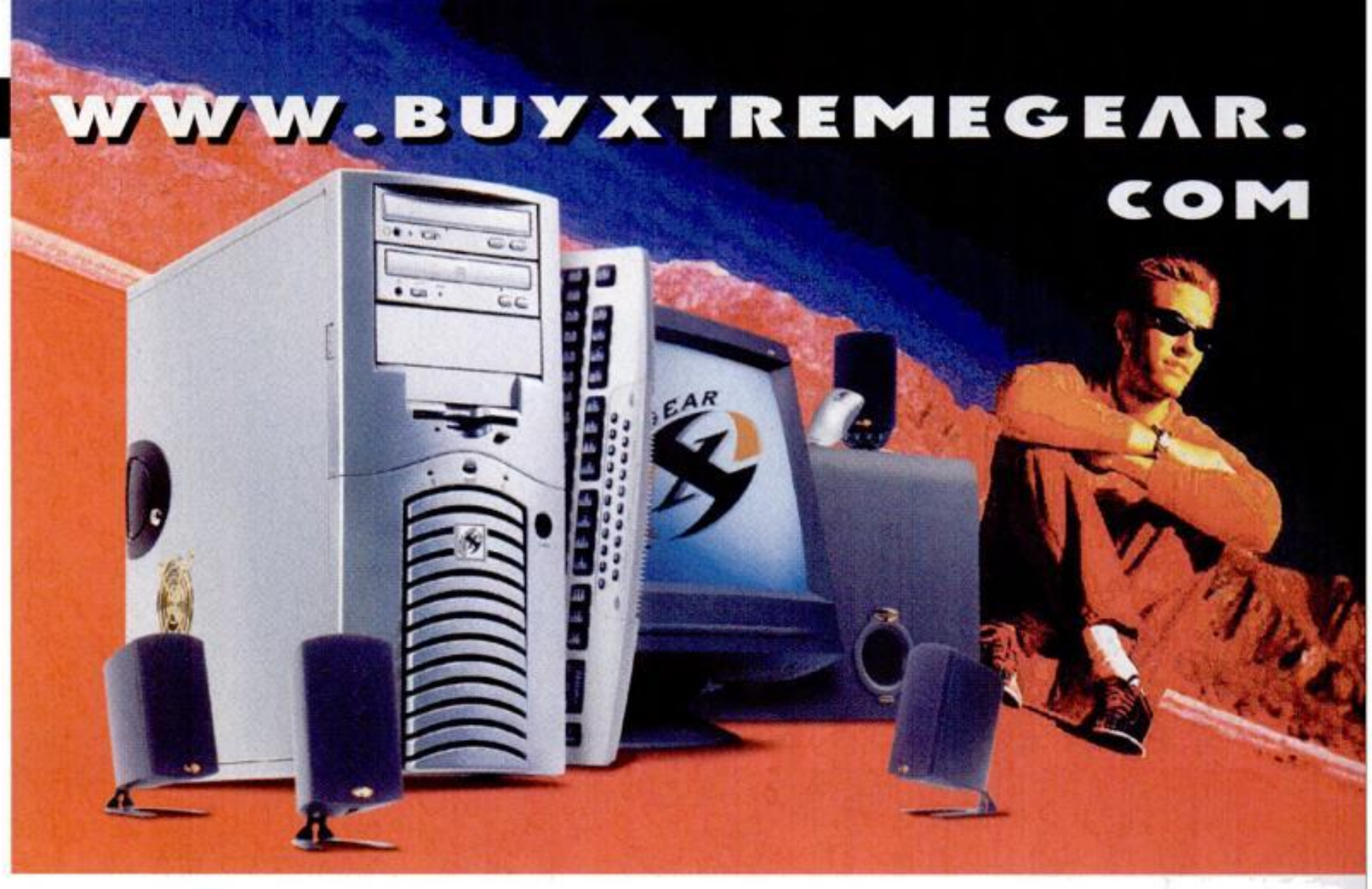

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- MSI KT4 Ultra ARU VIA KT-400 w/ ATA 133 MB
- Kingston 1024MB PC3200 400 MHZ DDR
- MSI ATA 133 Raid Build-In
- Western Digital 120GB 7200 RPM 8MB Cache Special Edition
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- Toshiba 16X DVD-ROM & Sony 40X12X40 CD-RW Drive
- Creative Labs Sound Blaster Audigy X-Gamer 5.1 w/ 1394 IEEE
- Creative Cambridge SoundWorks Desk Top Theater 5.1 Insprie 5300 Sound System
- Creative Labs 56K V.92 Fax Modem w/ Voice
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|---|---|---|
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| AMD Athlon™ XP 2400+[2] | $ 1485 | XG1152 |
| AMD Athlon™ XP 2200+[3] | $ 1445 | XG1153 |
| AMD Athlon™ XP 2000+[4] | $ 1415 | XG1154 |
| AMD Athlon™ XP 1800+[5] | $ 1385 | XG1155 |

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- Maxtor 80GB 7200 RPM Ultra ATA 133 Hard Drive
- MSI NVIDIA Geforce-4 TI4200 128MB DDR w/ TV Out and DVI
- Toshiba 16X DVD-ROM & Sony 40X12X40 CD-RW Drive
- Creative Lab Sound Blaster Live Audigy w/ FireWire 1394 IEEE Port
- Altec Lansing 251 5.1 PC Gaming Desktop Theater Speakers System
- 56K Modem, 1.44MB Floppy, Keyboard & Mouse
- Microsoft Windows XP Home Edition
- One Year On Site Service w/ 24/7 Techsupport
- **-AHANIX Platnium XP Case w/ Digital Thermometer & 420 Watt Power Supply**

| | | |
|---|---|---|
| AMD Athlon™ XP 2600+[1] | $ 1149 | XG1131 |
| AMD Athlon™ XP 2400+[2] | $ 1079 | XG1132 |
| AMD Athlon™ XP 2200+[3] | $ 1045 | XG1133 |
| AMD Athlon™ XP 2000+[4] | $ 1015 | XG1134 |
| AMD Athlon™ XP 1800+[5] | $ 965 | XG1135 |

## XG2000-ELITE

- MSI KT3 Ultra-2 VIA KT-333 w/ ATA 133 MB
- 512 MB PC2700 266MHZ DDR RAM Memory
- 60GB 7200RPM Ultra ATA 100 Hard Drive
- NVIDIA Geforc-2 MX400 64MB AGP
- Sony 52X CD-ROM, 3D Wavetable Sound
- 480-Watt Subwoofer Speakers System
- 56K Modem, 1.44MB Floppy, Keyboard & Mouse
- Microsoft Windows XP Home Edition
- **Black X-Gamer Medium Tower Case with See Through Window and Sound Activated Neon Light 350 Watt**

| | | |
|---|---|---|
| AMD Athlon™ XP 2600+[1] | $ 785 | XG1111 |
| AMD Athlon™ XP 2400+[2] | $ 709 | XG1112 |
| AMD Athlon™ XP 2200+[3] | $ 675 | XG1113 |
| AMD Athlon™ XP 2000+[4] | $ 615 | XG1114 |
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- Viewsonic E95 .22H 19" 1600x1200 (White) ..... $ 189
- Viewsonic E90F Perfect Flat .22H 19" 1600x1200 (Black or White Color) ..... $ 269

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- MSI 845E-MAX-C Intel I845E Chipset 533Mhz FSB MB
- 256MB PC2100 DDR Memory
- 60GB 7200 RPM Ultra ATA 100 Hard Drive
- MSI NVIDIA Geforce-4 MX 440 64MB DDR w/ TV-OUT
- 16X DVD-ROM & 32X12X40 CD-RW Drive
- MSI 6 Channels 5.1 Surround Sound Card
- 480-Watt Subwoofer Speakers System
- 56K Modem, 1.44MB Floppy, Keyboard & Mouse
- Microsoft Windows XP Home Edition
- **Black X-Gamer Medium Tower Case with See Through Window and Sound Activated Neon Light 350 Watt**

| | | | |
|---|---|---|---|
| Intel® Pentium® 4 | 2.53Ghz | $ 779 | XG1121 |
| Intel® Pentium® 4 | 2.4Ghz | $ 729 | XG1122 |
| Intel® Pentium® 4 | 2.0Ghz | $ 695 | XG1123 |
| Intel® Pentium® 4 | 1.8Ghz | $ 675 | XG1124 |

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- Western Digital 120 GB 7200 RPM 8MB Cache Special Edition
- NVIDIA Geforce-4 TI4600 128MB DDR w/ TV out & DVI
- Sony 40X12X40 CD-RW Drive
- Toshiba 16X DVD-ROM
- Creative Labs Sound Blaster Audigy X-Gamer 5.1 w/ 1394 IEEE
- Creative Cambridge SoundWorks Desk Top
- Theater 5.1 INSPIRE 5300 Sound System
- Creative Labs 56K V.92 Fax Modem w/ Voice
- 10/100 Network Interface Card
- 1.44 MB Floppy Drive & PS2 internet Keyboard
- Microsoft USB Optical IntelliMouse
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- One Year On Site Service w/ 24/7 Techsupport
- **All Aluminum Kingwin KT436 Tower Case 420Watt w/ 3 See Through Windows & Sound Activated Neon Light**

| | | | |
|---|---|---|---|
| Intel® Pentium® 4 | 2.8Ghz 533FSB | $ 1965 | XG1141 |
| Intel® Pentium® 4 | 2.6Ghz 533FSB | $ 1865 | XG1142 |
| Intel® Pentium® 4 | 2.53Ghz 533FSB | $ 1695 | XG1143 |
| Intel® Pentium® 4 | 2.4Ghz 533FSB | $ 1645 | XG1144 |
| Intel® Pentium® 4 | 2.26Ghz 533FSB | $ 1639 | XG1145 |

1. QuantiSpeed™ architecture outperforms competive 2.60GHz processors, QuantiSpeed™ architecture operates at 2.13GHz.
2. QuantiSpeed™ architecture outperforms competive 2.40GHz processors, QuantiSpeed™ architecture operates at 2.00GHz.
3. QuantiSpeed™ architecture outperforms competive 2.20GHz processors, QuantiSpeed™ architecture operates at 1.80GHz.
4. QuantiSpeed™ architecture outperforms competive 2.00GHz processors, QuantiSpeed™ architecture operates at 1.67GHz.
5. QuantiSpeed™ architecture outperforms competive 1.80GHz processors, QuantiSpeed™ architecture operates at 1.533GHz.

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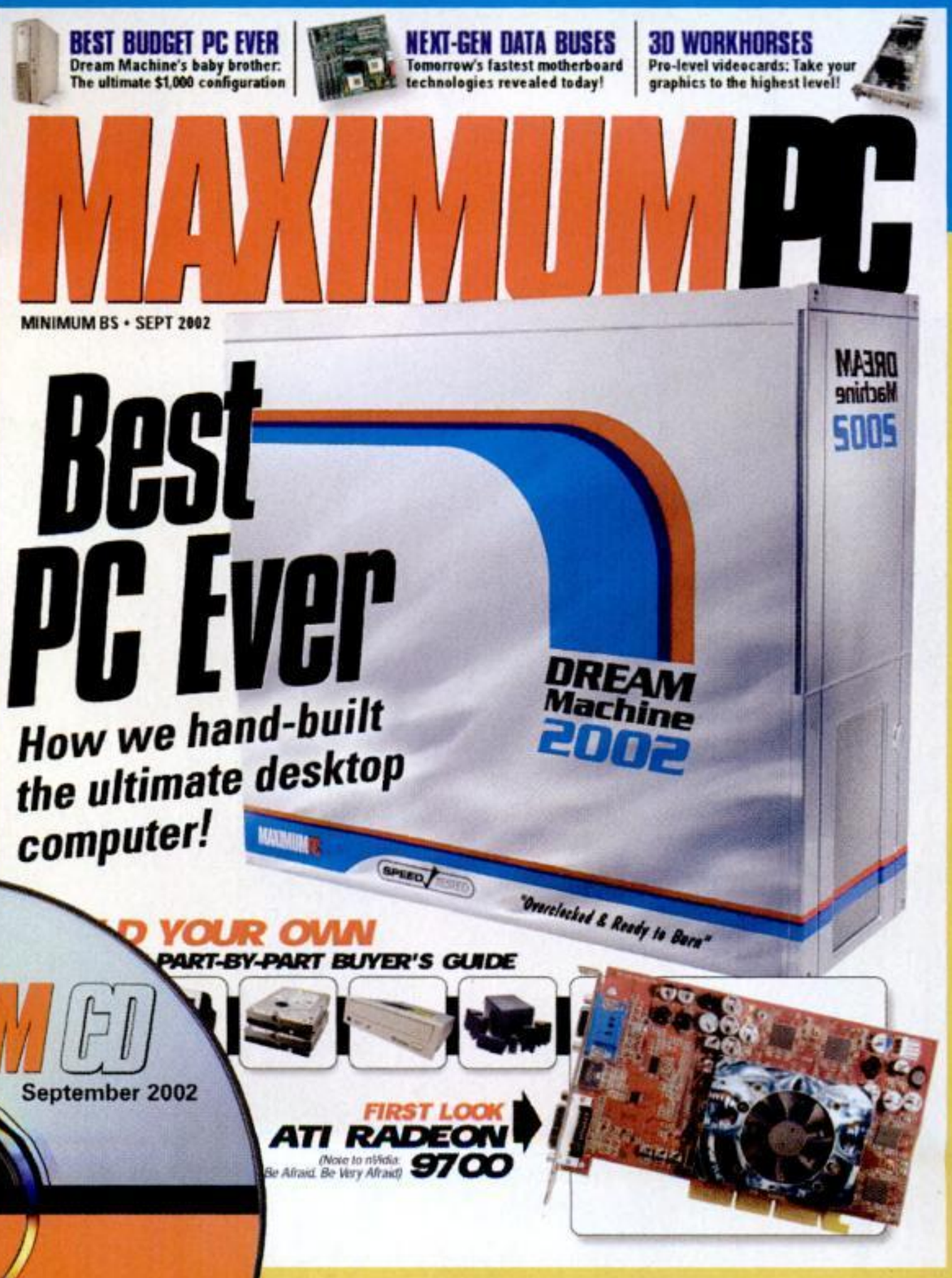


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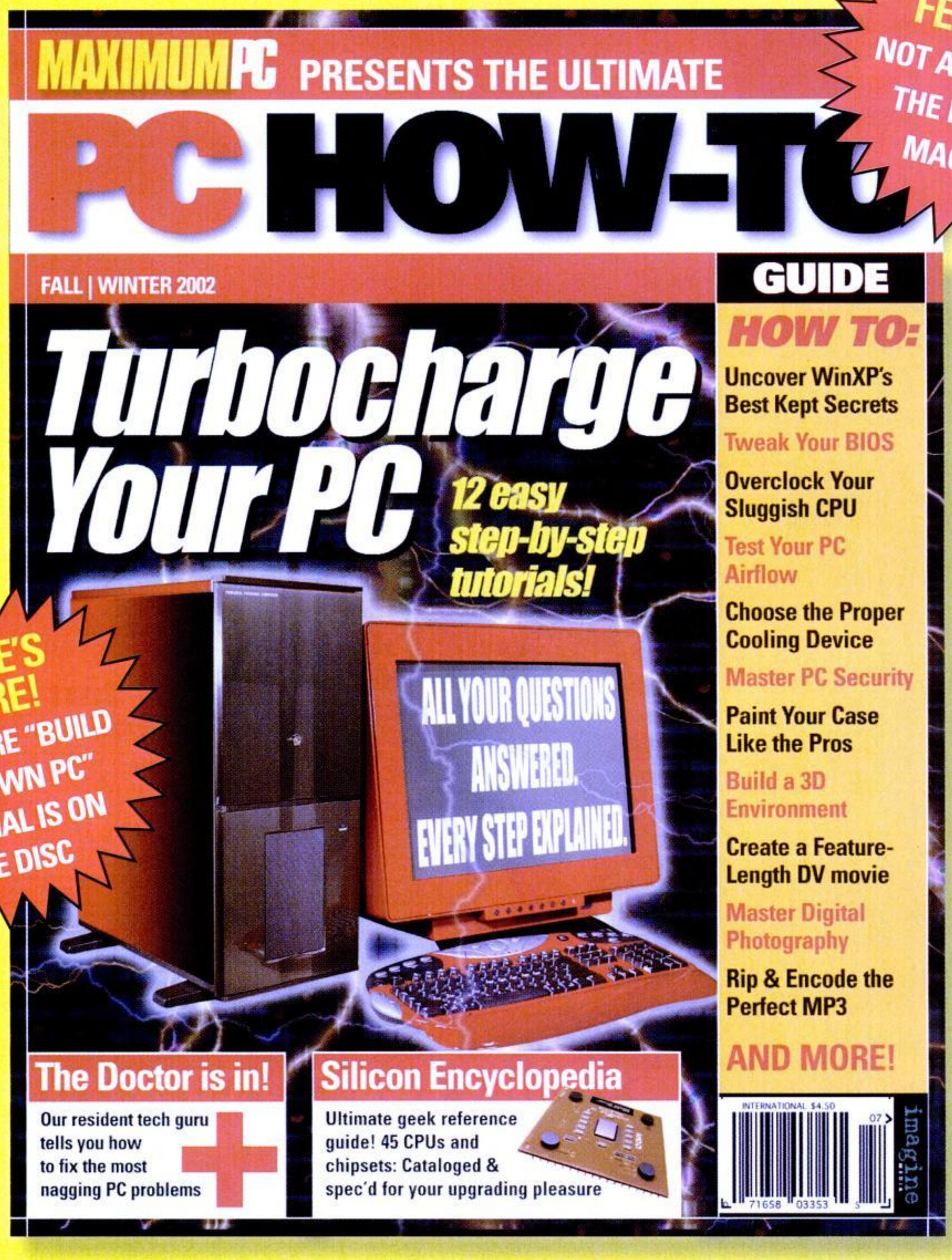
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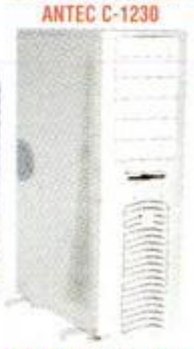

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| 103M.ATX 370 | 85 | 12.75x17.3x4 | PS2 KB,mouse,VGA,USB,RJ45,2S,1P,AUDIO, GAME PS2 | 1 | 1/1 | mini 2 or | 0 |
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|---|---|---|---|---|---|
| R02/BARE | 19x17.6x3.5 | M.ATX | 1/0 | 1/1 | 150W |
| R04B/W | 19x24.3x3.5 | ATX | 1/0 | 1/3 | 250W |
| R05B | 19x242x3.5 | ATX | 1/0 | 1/4 | 430W |
| R06B | 19x20.2x5.25 | ATX | 4/0 | 1/5 | 300W |
| R08 B/W | 19x22x3.5 | | | | |
| R14 B/W | 19x21x7 | ATX | 3/0 | 1/3 | 300W |
| R15 | 19x24.4x7 | ATX | 6/0 | 2/2 | 300W |
| R16 B/W | 19x18x7 | ATX | 3/0 | 1/2 | 250W |
| R17 B 4U | 19x21x7 | ATX | 3/0 | 1/2 | 250W |
| R20 B/W | 19x20.5x7 | | 8/0 | | 300W |
| R21 B/W | 19x18x7 | | 8/0 | | 300W |
| R26R/B/W | 19x22.6x10.7 | ATX | 4/0 | 2/4 | 300W/R |
| R28 | 19x17x8.7 | | 8/0 | | 300W |
| RSP | 5.8x9.3x1.6 | | | 1 | |
| RSM169-100 | 5.8x9.3x1.6 | | | 1 | |
| 001B | 10x11.5x3 | | 1/0 | | 60W |
| 001B1 | 8.3x10.6x2.8 | | 1/0 | | 50W |
| 002B | 6.9x14.6x5.8 | | 2/0 | | 60W |
| 002B1 | 7.5x11.2x6.5 | | 2/0 | | 80W |
| 004B | 6.8x15.3x9.3 | | 4/0 | | 230W |
| 004B1 | 7.5x17.3x10.2 | | 4/0 | | 200W |
| 007B | 7x15.8x13 | | 7/0 | | 250W |
| 008B | 8.4x20.2x18.3 | | 8/0 | | 300W |
| 008B1 | 7.5x17.9x17.1 | | 8/0 | | 250W |
| 105LPX/TV | 11.9x12.6x3 | LPX | 1/0 | 1/1 | 90W |
| 107 bare | 5.75x6.2x1.9 | | 1slim/0 | 0/1slim | |
| 111N bare | 11.6x10.6x2.5 | M.NLX | 1/0 | 0/1 | 100W |
| 192M ATX/B | 13.1x16.5x3.5 | M.ATX | 1/0 | 1/1 | 150W |
| 224 | 17.4x18.8x6.1 | ATX | 3/0 | 2/2 | 300W |
| 267 | 16.8x16.8x6.2 | ATX | 2/0 | 2/1 | 300W |
| 271 | 17.3x15.9x5.5 | ATX | 2/0 | 1/1 | 250X |
| 288 | 16.9x17x6 | ATX | 3/0 | 2/1 | 300W |
| 304 | 7.9x18.8x13.9 | ATX | 3/0 | 2/1 | 300W |
| 325B | 8x18.5x17 | ATX | 3/0 | 2/1 | 250W |
| 338 | 7x14.7x13.8 | M. ATX | 2/0 | 2/1 | 145W |
| 366 | 7.2x15.5x14.3 | M. ATX | 2/0 | 1/1 | 250W |
| 367 | 7.7x16.5x17 | ATX | 3/0 | 2/1 | 250W |
| 370 | 8.3x17.3x16.1 | ATX | 3/0 | 2/2 | 250W |
| 401 | 8.5x17.3x18 | ATX | 2/0 | 2/2 | 300W |
| 404 | 8x18.8x17 | ATX | 4/0 | 2/2 | 320W |
| 405B | 7.8x17.5x17.2 | ATX | 4/0 | 2/2 | 320W |
| 409 | 9.5x22x18.1 | ATX | 4/0 | 2/5 | 300W |
| 411 | 7.2x17.2x16.8 | ATX | 4/0 | 2/1 | 300W |
| 412 | 7.2x17.2x16.8 | ATX | 4/0 | 1/2 | 300W |
| 413BL | 8.5x19.5x18 | ATX | 4/0 | 2/1 | 300W |
| 415 | 8.8x19.5x19.7 | ATX | 8/0 | 1/0 | 300W |
| 418B/W | 8.1x18.8x21.4 | ATX | 4/0 | 2/4 | 300W |
| 422 | 7.7x16.6x18.1 | AT | 4/0 | 1/4 | 300W |
| 424 | 7.5x18.9x16.7 | ATX | 4/0 | 2/1 | 300W |
| 426B/W/S | 7.5x17.5x19.3 | ATX | 3/0 | 2/2 | 300W |
| 427 | 7.5x16.5x17.3 | ATX | 3/0 | 2/2 | 300W |
| 430 BL/BK | 8.25x19.75x18 | ATX | 4/0 | 3/6 | 300W |
| 433 | 7.8x19.7x17.9 | ATX | 4/0 | 2/5 | 300W |
| 436 | 8.6x18x15.6 | ATX | 3/0 | 2/2 | 300W |
| 443 | 8x18.8x17 | ATX | 4/0 | 2/2 | 300W |
| 467 | 7.5x16.7x18.8 | ATX | 3/0 | 1/4 | 300W |
| 470 | 8.3x17.3x21.3 | ATX | 4/1 | 1/2 | 300W |
| 471 | 8.4x17.5x21.3 | ATX | 3/1 | 1/4 | 300W |
| 472 | 7.5x18x17.6 | ATX | 4/0 | 2/2 | 300W |
| 474 | 7.8x17.2x17.2 | ATX | 4/0 | 2/2 | 300W |
| 476 | 8x17.2x17 | ATX | 4/0 | 2/2 | 300W |
| 477BL | 8.75x17.5x17 | ATX | 4/0 | 2/2 | 300W |
| 478 | 7.9x18.4x16.4 | ATX | 4/0 | 2/1 | 300W |
| 480 | 7.8x18x16.5 | ATX | 4/0 | 2/1 | 300W |
| 482B | 7.8x19.8x17.5 | ATX | 4/0 | 2/2 | 300W |
| 486 | 9.6x19.5x17 | ATX | 4/0 | 2/1 | 300W |
| 487B/W | 8.25x18.4x21.25 | ATX | 4/0 | 2/4 | 300W |
| 489** | 7.3x17x17 | ATX | 3/0 | 1/2 | 300W |
| 492 | 8.3x19.5x17.6 | ATX | 4/0 | 3/5 | 300W |
| 493B | 8.3x19.5x17.6 | ATX | 4/0 | 3/5 | 300W |
| 494 | 8.3x19.5x17.6 | ATX | 4/0 | 3/5 | 300W |
| 496 | 8.25x17.8x16.5 | ATX | 4/0 | 1/3 | 300W |
| 501 | 8.25x17.2x23.8 | ATX | 4/0 | 2/4 | 300W |
| 503R/B | 14.8x20.4x18.4 | ATX | 8/0 | 2/4 | 300RW |
| 503/B | 14.8x20.4x18.4 | ATX | 8/0 | 2/4 | 300W |
| 505 | 14.6x23x26.8 | ATX | 12/0 | 1/8 | 300W |
| 505R | 14.6x23x26.8 | ATX | 12/0 | 1/8 | 300RW |
| 518 | 8.1x18.5x26.5 | ATX | 6/0 | 2/6 | 300W |
| 524 | 13.9x25.6x19.1 | ATX | 7/0 | 1/2 | 300RW |
| 526B/W | 7.5x17.5x24.5 | ATX | 6/0 | 1/4 | 300W |
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| 536 | 7.8x17x24 | ATX | 5/0 | 1/5 | 300W |
| 560/R | 15x24.5x23.5 | ATX | 11/0 | 2/4 | 300W/300R |
| 562/R/B/W | 8.7x17.9x26.8 | ATX | 9/1 | 1/0 | 300W/300R |
| 563/RB/W | 8.7x17.9x26.8 | ATX | 10/0 | | 300W/300R |
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| 569B/W | 13.5x17.8x14 | B/ATX | 6/2 | 0/8 | 300W/300W |
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| 571/R | 8.3x17.3x26.4 | ATX | 6/1 | 1/2 | 300W/300R |
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| 588 | 7.8x16.5x23.3 | ATX | 5/0 | 1/3 | 300W |
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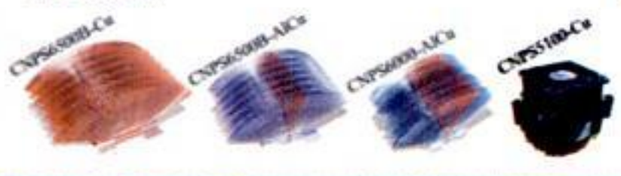


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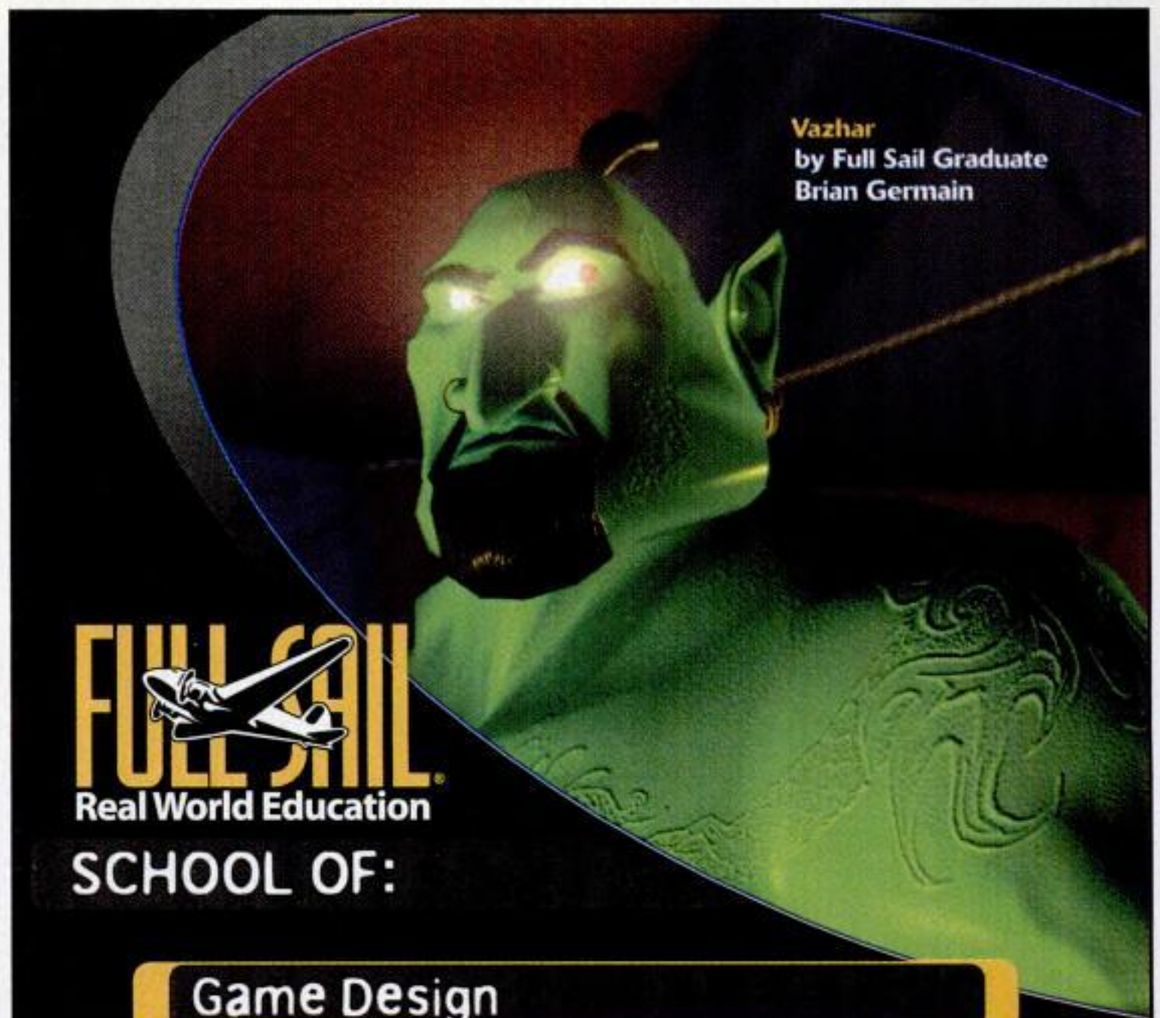


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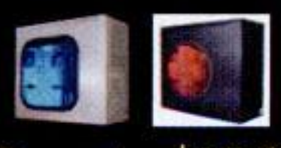

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| Corsair Value Select 256MB PC2700 CAS 2.5 | CMVS256MB333 | $69.00 |
| Corsair Value Select 256MB Rambus PC800 | CMVS256MB800 | $94.00 |
| Corsair Value Select 512MB PC2100 CAS 2.5 | CMVS512MB266 | $114.00 |
| Corsair Value Select 512MB PC2700 CAS 2.5 | CMVS512MB333 | $139.00 |

## HARD DRIVES

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|---|---|---|
| Western Digital 40GB Ultra 7200rpm SE | WD400JB | $82.00 |
| Western Digital 60GB Ultra 7200rpm SE | WD600JB | $100.00 |
| Western Digital 80GB Ultra 7200rpm SE | WD800JB | $104.00 |
| Western Digital 100GB Ultra 7200rpm SE | WD1000BBSE | $129.00 |
| Western Digital 120GB Ultra 7200rpm SE | WD1200JB | $159.00 |
| Western Digital 200GB Ultra 7200rpm SE | WD2000JB | $389.00 |
| Seagate 18.4GB ULTRA160 SCSI 15K RPM | ST318452LW | $209.00 |
| Seagate 36.7GB ULTRA160 SCSI 15K RPM | ST336752LW | $359.00 |
| Seagate 20GB ATA100 5400RPM | ST320014A | $59.00 |
| Seagate 40GB ATA100 7200RPM | ST340016A | $74.00 |
| Seagate 40GB ATA100 5400RPM | ST340810A | $67.00 |
| Seagate 60GB ATA100 7200RPM | ST360021A | $92.00 |
| Seagate 80GB ATA100 7200RPM | ST380021A | $104.00 |

## VIDEO CARDS

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|---|---|---|
| MSI Geforce4 MX420 64MB | MICG4MX420D-T | $64.00 |
| MSI Geforce4 MX440 64MB | MICG4MX440-T | $79.00 |
| MSI Geforce4 MX440 64MB VIVO | MICG4MX440-VTP | $89.00 |
| MSI Geforce4 MX460 64MB VIVO | MICG4MX460-VT | $112.00 |
| MSI Geforce4 TI 4200 128MB | MICG4TI4200-TD | $159.00 |
| MSI Geforce4 TI 4600 128MB | MICG4TI4600-TD | $259.00 |
| MSI Geforce4 TI 4600 128MB VIVO | MICG4TI4600-VTD | $299.00 |
| Asus Geforce4 TI 4200 128MB | ASV8420128A | $174.00 |
| Asus Geforce4 TI 4200 128MB Ultra Deluxe | ASV8420UD128A | $219.00 |
| Asus Geforce4 TI 4600 128MB | ASV8460128A | $309.00 |
| ATI Radeon 9700 Pro 128MB Retail Box | ATIR9700128R | $359.00 |
| ATI Radeon 9000 128MB | ATIR900012800EM | $89.00 |
| ATI Radeon 9000 Pro 64MB | ATIR9000PRO64OEM | $89.00 |

## MOTHERBOARDS

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|---|---|---|
| MSI VIA KT333 ATHLON XP DDR ATA133 RAID | MICKT3ULTRA2-R | $109.00 |
| MSI VIA KT400 ATHLON XP | MICKT4ULTRA | $99.00 |
| MSI VIA KT400 ATHLON XP SERIAL ATA RAID | MICKT4ULTRA-SR | $119.00 |
| MSI INTEL 850E P4 RAMBUS | MIC850EMAX-L | $149.00 |
| MSI INTEL 845E P4 DDR BLUETOOTH | MIC845EMAX2-BLR | $159.00 |
| MSI SIS 648 P4 DDR | MIC648MAX-L | $99.00 |
| Asus VIA KT333 ATHLON XP DDR AMD ASSURED | ASA7V266-E-WOR | $89.00 |
| Asus VIA KT333 ATHLON XP DDR ATA133 RAID | ASA7V333-WR | $129.00 |
| Asus VIA KT400 ATHLON XP SERIAL ATA | ASA7V8X | $139.00 |
| Asus INTEL 850E P4 PC1066 ATA100 | ASP4T533-CWA | $169.00 |
| Asus INTEL 850E P4 232PIN RDRAM PC1066 | ASP4T533-WA | $174.00 |
| Asus SIS 645DX P4 DDR ATA133 | ASP4S533-WA | $94.00 |
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| Abit VIA KT400 ATHLON XP ATA133 | ABKD7 | $109.00 |
| Abit VIA KT400 ATHLON XP ATA133 RAID | ABKD7-RAID | $124.00 |
| Abit VIA KT400 ATHLON XP SERIAL ATA | ABAT7MAX2 | $159.00 |
| Abit INTEL 845E P4 DDR SERIAL ATA | ABIT7MAX2 | $174.00 |
| Abit SIS 648 P4 DDR ATA133 | ABSR7-8X | $99.00 |

## PROCESSORS

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| AMD Athlon XP 1800+ | AMDXP1800BOX | $79.00 |
| AMD Athlon XP 1900+ | AMDXP1900BOX | $89.00 |
| AMD Athlon XP 2000+ | AMDXP2000BOX | $99.00 |
| AMD Athlon XP 2100+ | AMDXP2100BOX | $109.00 |
| AMD Athlon XP 2200+ | AMDXP2200BOX | $144.00 |
| AMD Athlon XP 2400+ | AMDXP2400BOX | $219.00 |
| Intel Pentium 4 2.4MHz | INP4-533-240BOX | $204.00 |
| Intel Pentium 4 2.53MHz | INP4-533-253BOX | $254.00 |
| Intel Pentium 4 2.67MHz | INP4-533-267BOX | $424.00 |
| Intel Pentium 4 2.8MHz | INP4-533-280BOX | $519.00 |

## OPTICAL DRIVES

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| Asus DVR-104 IDE DVD-RW | ASDVR-104 | $299.00 |
| Asus CRW-4816A 48X16X48 IDE CDRW | ASCRW-4816A | $64.00 |
| Yamaha CRW-F1ZE 44X24X44 IDE CDRW | YACRW-F1ZEKIT | $164.00 |
| Yamaha CRW-F1ZE 44X24X44 IDE CDRW Black | YACRW-F1ZENKIT | $184.00 |
| Yamaha CRW-F1ZUX 44X24X44 USB 2.0 CDRW | YACRW-F1ZUXKIT | $209.00 |
| LITE-ON 16X IDE DVD 40X CDROM | LIT16XDVD | $38.00 |
| LITE-ON 16X IDE DVD 40X CDROM Black | LIT16XDVDBLACK | $45.00 |
| LITE-ON 48X12X48 IDE CDRW | LIT48X12X48 | $69.00 |
| LITE-ON 48X12X48 IDE CDRW Black | LIT481248BLACK | $74.00 |

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# MAXIMUM PC Rig of the Month

## THIS MONTH: Richard Robbins' Multiboot Menagerie

**This month's rig doesn't have Plexiglas portals or sport a fancy-pants paint job, but behind its plain-Jane exterior are no fewer than 37 operating systems! Make that 53 if you count the DOS window managers.**

The rig's audacious architect is 18-year-old Richard Robbins—an Eagle Scout, all-state jazz drummer, and tireless OS enthusiast who drove with parental units and PC all the way from Southern Utah to our offices in Brisbane, CA just so we could verify the authenticity of his creation. Is this guy nuts? No. But he does confess that he launched the Menagerie project specifically because an online computer expert said it couldn't be done.

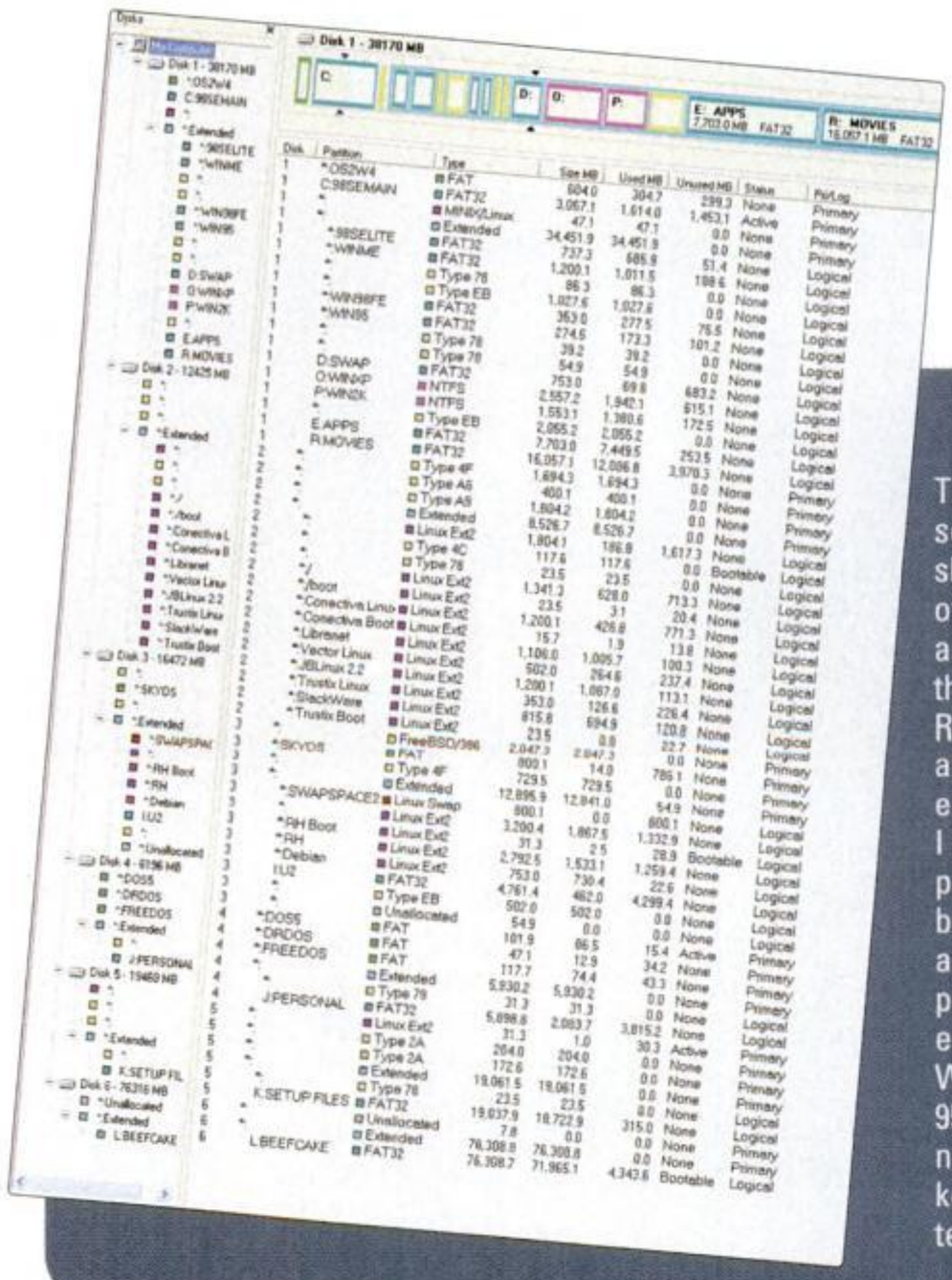
All the OSes are loaded onto six hard drives, and divvied across five separate boot menus with the help of a freely distributed bootloader called *XOSL* (www.xosl.org). When challenging Richard to successfully load any OS our little hearts desired, we were amazed by the variety—and antiquity—of what he managed to boot. It was nice to see BeOS (sublime, efficient), OS/2 Warp IV (vexingly quaint), and a bunch of Linux distributions (rebellious and defiant). But we were most charmed by Windows 1.01, which was just a few pixels away from looking like a basic DOS screen.

"The main challenge is figuring out each OS's requirements," Richard says. "A lot of systems won't boot if they're installed past the 1024th hard drive cylinder, and some systems require a primary partition and/or a swap partition, as well. You just have to do the research to find out the requirements for each system. Keeping my sanity was a definite issue, as well as finding bandwidth to download 500MB ISOs."

Richard says it was extremely difficult getting all the OSes to cooperate. Some OSes were rejected by the system outright, and in other cases, he would install an OS only to discover the addition harmed his existing configuration. "It's like putting a pit bull, cat, parakeet, komodo dragon, wolverine, rattlesnake, and duckbill platypus all in a 10x10 room, and saying, 'Now please get along, children.' In that case, you would need separate compartments for each animal. Partition hiding, in this sense, divides the room into separate compartments, and keeps the predators away from the prey."

For the full list of Richard's OSes as well as more information on the Multiboot Menagerie, go to MaximumPC.com.

**37 OSes! AMAZING!**




This *Partition Magic* screenshot shows the sheer extensiveness of Richard's primary and logical drives. Of the *XOSL* bootloader, Richard says, "It's an amazing boot manager, and there is no way I could have done the project without it. Its best feature is the ability to hide certain partitions for certain entries. This way, Win98 doesn't see ME, 95, or anything else it's not supposed to. It keeps all of the systems nice and happy."

The Menagerie features four 5400rpm Maxtors, one 7200rpm Maxtor, and one 7200rpm Western Digital. The rig's VIA chipset, 1GHz P-III, and ATI Rage 128 graphics were surprisingly OS-friendly. A 350-watt PSU powers everything.

Editor Jon Phillips (right) shakes Richard's hand after verifying the Menagerie as a bona fide 37-operating-system-running freak of PC nature. Kudos go out to Richard's parents for driving their son to California (we insisted on seeing the PC in person). The Certificate of Authentication seen in this photo now resides in the magazine's official archive.

If you have a contender for Rig of the Month, e-mail **input@maximumpc.com** with pics and a brief write-up.



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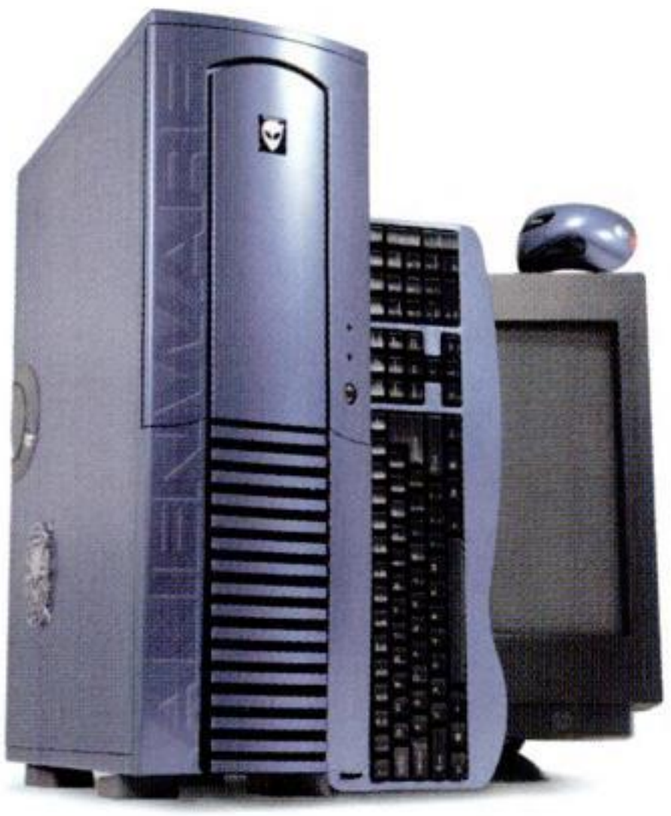


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